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EPIDEMIC MENINGITIS,

OR

CEREBRO-SPINAL MENINGITIS.

BY

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"Looking at the disease as an object of study, I know of nothing which surpasses it in interest."—GASKOIN.

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To the Clinical Class of the Philadelphia Hospital, for 1866–67.

Gentlemen:

It is a pleasure, and indeed it is almost a duty, to inscribe this little work to you, who enjoyed with me the rare opportunity of studying an epidemic of meningitis. It will, perhaps, serve to recall many things which you would otherwise have forgotten, and to impress you with a clearer idea of this curious disease than you could obtain from the fragmentary remarks made at our clinical conferences.

Availing myself of this opportunity to commend your diligent and patient attendance upon our meetings, and to thank you for the many other evidences of the interest which you manifested in our common labors,

I remain, very faithfully, your obedient servant,

Alfred Stillé.

1500 Walnut Street, *September*, 1867.

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EPIDEMIC MENINGITIS.

As the epidemic meningitis which has ravaged the United States for the last ten or eleven years, appears to be approaching the termination of its career, the present seems to be a fitting occasion for reviewing its course, and studying its analogies with European and other American epidemics of the same disease, and for guarding, if possible, future generations of physicians against the misconceptions and mistakes, the confusion of ideas and the still greater confusion of terms, which, even now, have not altogether ceased to have currency among professional teachers and writers. We have been the more strongly moved to attempt placing the subject in a clear light, by the practical acquaintance with it, which we acquired during the first quarter of the present year, while studying about one hundred and twenty cases of the disease in the Philadelphia Hospital. Nearly one hundred of them form the subject of a very valuable Report

contributed by Dr. Githens to the *American Journal of the Medical Sciences*. In the corresponding term of the previous year we witnessed a still more extensive and fatal epidemic of typhus fever in the same Institution, where, also, thirty years before, we had become familiar with that fever as a resident physician of the hospital during the great epidemic, the history of which is so honorably associated with the names of Gerhard and Pennock. Such opportunities were peculiarly fitted to reveal the grounds of the common error of confounding epidemic meningitis and typhus fever, into which physicians acquainted with one only of these affections have been prone to fall, as well as to illustrate the surprising variety of morbid phenomena which the former exhibits by virtue of its double character as a blood disease, and an inflammation of the cerebro-spinal membranes.

HISTORY.

Nothing illustrates more clearly the value of morbid anatomy as an element of medical diagnosis than the inextricable confusion which involves nearly all of the descriptions of this disease which were written before the scalpel revealed the lesions which essentially belong to it. There is no doubt whatever that numerous histories of "Fever," of "Typhus," &c., related by authors of the last and previous centuries included cases of epidemic meningitis; but it was not recognized as a distinct affection until the beginning of the present century. Some writers, who trace it back to the fourteenth century would be sorely at

fault if they attempted to disentangle it from the various epidemic diseases which the history of medicine records, and especially from that of typhus with which it was, and by some persons continues to be, confounded. When we remember that it was not until 1836 that, in recent times, typhus was shown to be a distinct disease from typhoid fever, and that to this day the former term is applied by many German writers to both affections indiscriminately, it is not to be wondered at that epidemic meningitis should have been involved in the same confusion. Indeed, so accomplished an author as Hirsch, misled by some of the early histories of the disease published in this country, and unacquainted with the cotemporary post-mortem investigations which would have enlightened him, concludes that the old "spotted fever" had nothing in common with the affection we are about to study. In all of these instances the lesions found after death have brought order out of confusion, and enabled us to distinguish typhus and typhoid fever from one another, and epidemic meningitis from both of them.

Restricting our historical review of the disease to the epidemics of it which have occurred since the beginning of the present century, and, rising for a moment above its individual and local outbreaks, our attention is at once arrested by a circumstance which removes it from the category of endemic, and even of epidemic diseases, in the ordinary sense of the latter word, and entitles it to the name *pandemic*. Unlike typhus, and typhoid and yellow fevers, its rise and progress are connected with no antecedents of animal

or other putrefaction; nor with any miasmatic, cryptogamic or analogous agent, like periodical fevers; nor with any telluric or aqueous emanation like dysentery; nor with a special poison like cholera, smallpox, or measles. All of these diseases have, moreover, a distinctly ascertainable starting point from which they widely extend; or else their ravages are confined within comparatively narrow limits; but with epidemic meningitis the case is very different. Its outbreaks have occurred almost simultaneously in regions as widely separated as Europe is from America, and annually it has made a mid-winter attack upon towns and rural districts, the salubrious and unhealthy alike, completing the cycle of its progress in a period varying between ten and fifteen years. Three such periods, at least, have occurred during the present century. The first, of eleven years, began in 1805 and terminated in 1816; the second, of thirteen years, occurred between 1837 and 1850; and the third extends from 1856 to the present time, and has already lasted for eleven years, during which the disease has been almost constantly present in Europe, but absent during four years from the United States. These two conditions, of simultaneous appearance in widely remote places, and of annual recurrence for a series of years, characterize no other disease whatever. The first, indeed, is fulfilled by influenza; and it was perhaps a dim perception of the analogy we have pointed out which led one writer, at least, (Wilson), to imagine the two diseases to be identical, a proposition which at the present day may provoke a smile, but hardly calls for refutation. But no other disease than influenza affords an

example of the former condition singly, and none but epidemic meningitis of both combined.

The first account of epidemic meningitis within the period we have referred to was published in 1805, by Vieusseux, who at once declared that neither he nor any of his colleagues had ever seen a similar disease. It is also worthy of remark, that in this particular epidemic a petechial eruption was a prominent symptom, that engorgement of the brain existed in most of the fatal cases, and that its historian describes it as "a malignant non-contagious fever." If any doubts should be entertained respecting the identity of this disease with epidemic meningitis, they will perhaps be dispelled by the account which Mathey furnishes of a dissection made in one of the fatal cases. He describes a gelatinous exudation as covering the convex surface of the brain, and a yellow puriform matter upon its posterior aspect, upon the optic commissure, the inferior surface of the cerebellum, and the medulla oblongata.*

In every one of the following years, until 1816, the same disease prevailed either in Prussia, Holland, Rhenish Germany, Bavaria, or the east of France, but no where else in Europe; while in the United States it began its course in 1806, at Medfield, in Massachusetts, and between that time and 1816 it

* Bascombe, in his "History of Epidemic Pestilences," speaks of a local epidemic at Rœttingen, in Franconia, in the autumn of 1802, in which the young and strong were suddenly seized with pain and anguish at the heart *and lacerating pains in the nape of the neck.* In the worst cases the patient fainted, the limbs became rigid, and death closed the scene frequently within twenty-four hours from the commencement of the attack.

extended throughout New England and into Canada, the State of New York, Pennsylvania, and other States to the South and West, precisely as it has done during the recent epidemic.

We possess no record of its occurrence between 1816 and 1822; but in the last named year, a local and temporary appearance of the disease was observed at Vesoul, in France; in 1823 at Middletown, Connecticut; in 1828 in Trumbull county, Ohio; in 1830 at Sunderland, England, and in 1833 at Naples.

After four years of quiescence it entered again upon a wide and destructive career, which lasted from 1837 to 1850. During the first two years of its recurrence in Europe, it was confined almost entirely to France; but during the third and fourth years it appeared also in Italy and Algeria and at Gibraltar, without, however, retreating from its original territory, where it continued to prevail until 1849, breaking out meanwhile at various points of the north of England and in Dublin, and from 1845 to 1848 in Denmark. While the epidemic was thus spreading through Europe, it again appeared in the United States at places as remote as possible from transatlantic communication, and hundreds of miles distant from one another; in Louisville, Kentucky, in Rutherford county, Tennessee, and in Montgomery, Alabama. This took place in 1842; and in the following years, the disease appeared in Arkansas, Mississippi and Illinois. In 1848 it occurred again at Montgomery, Alabama, and simultaneously in Beaver county, Pennsylvania; in 1849 it existed in Massachusetts and in Cayuga county, New York, and finally

at New Orleans, in 1850. It appears, therefore, that although the American epidemic began later than the European, it reached its period of extinction very nearly at the same time.

Between 1850 and 1854 epidemic meningitis had ceased to be heard of, when suddenly it broke out with destructive violence in Sweden, a country which had hitherto entirely escaped its ravages, and there it continued to prevail during the six years from 1854 to 1860. During this period local epidemics of very limited extent or sporadic cases occurred in Dublin, London, and in Stafford, England; and simultaneously the disease prevailed in several parts of the United States. On this, as on previous occasions, its starting points were remote from one another, as in North Carolina, where it appeared for the first time in March, 1856, and in the central portions of New York and Massachusetts at the commencement of 1857.

To return once more to Europe, we find that hardly had the epidemic ceased in Sweden, than it reappeared in Holland during the winter of 1860–61; and in the following year, at the same season, it spread over a large extent of the Portuguese territory. Germany, which had remained almost entirely exempt from the attacks of the disease since the first and very partial outbreak of 1806, was now the seat of an epidemic as widespread as that which had pervaded France. Beginning slightly in the summer of 1863, it acquired new vigor during the next winter, and for the two following years devastated almost every part of northern Germany, but, so far as we are informed,

penetrated but slightly into the Austrian empire. Simultaneously (1865) a local epidemic of the disease occurred in Dublin.

The counterpart of this epidemic, as on former occasions, appeared in the United States. The first point at which it broke out was Livingston county, Missouri, in the winter of 1861–62; and during the same season it invaded Indiana, Kentucky and Connecticut. From 1860 to 1864 it prevailed in Ohio, and during the last named year in Illinois. Cases of the disease occurred at Newport, Rhode Island, in 1863, and in Vermont in 1864. In 1863 the epidemic began in Philadelphia, and has renewed its appearance annually until the present time. During the same period it prevailed in Maryland, Virginia, North Carolina, Alabama, and other Southern States.

The coincidences which have now been pointed out are among the most striking occurrences in the history of this singular disease, and they are, as before remarked, characteristic of it alone. If there had been anything common in the origin of its epidemics, as climate, soil, or water, or the social condition, age, sex, occupation, or habits of the patients, a plausible, although even then an untenable, explanation of their simultaneous occurrence might be suggested; but, in point of fact, no single circumstance was common to all, or nearly all of them, except their outbreak in mid-winter. It follows, therefore, that, even at this stage of our inquiry, epidemic meningitis must be regarded as an exceptional affection, and, as before intimated, a true *pandemic* disease. Along with the more or less wide spread epidemics

which have now been considered, several instances are on record of this disease occurring in groups of two, three or four cases, in localities where it never at any time assumed the epidemic form. Not to cite instances of doubtful import, we shall refer only to those observed in England, where epidemic meningitis has never yet been known to prevail. In 1807, Dr. Gervis, of Ashburton, reported four such cases; in 1859, Dr. Day met with two such at Stafford; and in 1865, three cases were observed in London by Dr. Wilks, three by Dr. Ogle, and one by Dr. Martin. We shall not attempt to suggest an interpretation of these facts, which are not, however, without their significance.

GENERAL IDEA OF THE DISEASE.

The strangely contradictory opinions concerning epidemic meningitis which have been held by physicians of more than ordinary intelligence and information, are clearly traceable to their having seen but few cases of the disease, to their limited acquaintance with its diversified forms, or to their superficial study of its recorded history. No disease whatever wears such various masks of symptoms, behind which there is, nevertheless, a great uniformity of characteristic lesions. While one writer classifies its several forms as nervous, inflammatory and comatose, another describes them as neuralgic, delirious, convulsive, paralytic and comatose; and a third recognizes abortive, malignant, intermittent and typhoid forms, to which a fourth adds the chronic form,—the

lesions are essentially the same in all, although varying in degree as much as congestion does from exudation, and in extent from what is invisible to the naked eye to a profuse accumulation of inflammatory products. Yet the degree and extent of these lesions, and the greater or less energy in the primary impression of the morbid cause of the disease are the two elements, out of which this great variety in its phenomena arises. Just as in typhoid fever the blood disorder and the intestinal lesion combine to impress upon that disease a characteristic expression which is compounded of those two elements in various proportions, so that in one case the attack may terminate in coma before intestinal symptoms arise, or marked intestinal lesions are developed; and in another a prolonged diarrhœa and moderate fever may be almost the only prominent phenomena; so in epidemic meningitis the blood disease may vary through every grade, from extreme hypinosis to extreme hyperinosis, from typhoid symptoms to inflammatory, and the nervous disorder present those infinite diversities in degree and kind which depend upon the existence of congestion or of exudation in the membranes of the nervous centres, on the participation of one part or another of the brain or spinal marrow in the change, its degree and extent, and on the relative proportion of the blood and tissue changes in the aggregate lesions. Hence it is, that, in the description which is to follow, the reader must not expect to find a photographic miniature of the disease, by which any one may recognize it at a glance, but rather a succession of impressions differing very much from one another, but all

of them necessary to form an accurate picture of this chameleon-like disorder. It will greatly simplify the subject, however, to bear in mind the existence in every case of the two elements referred to above, the blood disorder and the nervous disorder; for to one or the other of the two all of the symptoms may be referred.

SKETCH OF THE SYMPTOMS.

It will readily be anticipated that, like other fatal epidemic diseases, meningitis is sometimes sudden and sometimes gradual in its development. In the former case, the patient on awaking suddenly from a sound sleep, or, while pursuing his ordinary avocations, may be attacked with chilliness, prostration, vomiting and headache, of which symptoms the last is often intensely distressing. As in other epidemic diseases, also, such seizures are most common during the earlier periods of its prevalence; but, later in its course, premonitory symptoms are more frequently observed. They may last for an hour or two, or may extend to several days; and, in general, it may be stated that the longer their duration the milder will be the subsequent attack. But the symptoms in either case are essentially the same; prostration, chilliness, feverishness, and sometimes vomiting and sharp pains in the head, back and limbs. The character of the vomiting, as well as the absence of all gastric lesions, prove that it is produced by an irritation of the brain. All of these symptoms, their succession and degree of gravity, were as fully described

and appreciated by North, Hale, Fish, and their co-temporaries during the first occurrence of the disease in the United States, as by Tourdes, Hirsch, Niemeyer, Mannkopf and other historians of recent European epidemics.

In the cases which may be called regular, these phenomena more or less gradually assume a graver aspect, or usher in a heavy chill, which, in its turn, is followed by alarming symptoms, and especially by excruciating pain in the head, a livid or pale and sunken countenance, and extreme restlessness. The pulse is as often slow as frequent, and the skin but little, if at all, warmer than natural. The vague pains which opened the attack are now concentrated, and seem to dart in every direction from the spine, which is also, especially at its upper part, the seat of severe aching; and, in a large proportion of the cases, its muscles become more or less rigidly contracted, so that the head is drawn backwards, or the whole trunk is arched, as in tetanus. Trismus is not uncommon, and clonic spasms frequently affect the extremities; even general convulsions are occasionally observed. As these phenomena grow more decided, delirium of various degrees is often manifested, from mere wandering and hallucinations during the sleepless watches of the night, to violent maniacal ravings, or incoherent mutterings, or the stertor of coma. As the attack advances, the pulse usually rises above the normal rate, and sometimes becomes extremely frequent; and the skin, although it grows warmer does not acquire the temperature observed in idiopathic fevers, nor sustain it as equably as in them. In many cases

eruptions appear upon the skin. During some epidemics the only one observed is herpes labialis; in in others the eruption resembles roseola, measles, or the mulberry rash of typhus, or, from the first, it consists of petechiæ, vibices, or extensive ecchymoses. The tongue presents the appearances which belong generally to the typhoid state; it is at first moist, then coated with a mucous secretion, then red and shining, or brown and fuliginous. There is a complete loss of appetite, and the thirst is not usually urgent. One or two liquid stools at the commencement are generally followed by constipation, which continues throughout the attack, although in very grave and protracted cases diarrhœa may exist and even become colliquative. When the attack tends to a fatal issue, the patient generally, but by no means always, sinks into a soporose condition, in which muscular relaxation, debility, and tremulousness, such as are common in typhus fever, are associated with paralysis of the sphincters and of other muscles. But we have seen rigid opisthotonos persist until within a few hours of death in a case of more than the average duration.

In cases which tend to terminate favorably the symptoms are rarely, if ever, so grave; and this remark applies more especially to the typhoidal symptoms than to the derangement of the nervous functions. Yet, wherever the latter has been decided, the return to health is tedious and uncertain, and not unfrequently a perfect restoration of all the functions is very long delayed, or, it may be, is never attained. Such, very briefly described, are the characteristic

symptoms of epidemic meningitis and the usual order of their succession. But, as before intimated, no single typical case, nor any general description, can accurately represent this Protean affection, as a whole, nor convey a just idea of its numerous grades and multiform aspects. They can best be apprehended after studying the variations presented by the individual symptoms. To these we shall now direct the reader's attention. As the earliest, usually, to make their appearance, and as most directly connected with the characteristic lesions of the disease, we shall study the

SYMPTOMS FURNISHED BY THE NERVOUS SYSTEM.

HEADACHE.—This is certainly one of the most constant of all the symptoms pertaining to epidemic meningitis. Except in those malignant and rapidly fatal cases, where the death-blow falls with lightning speed (*méningite foudroyante*), it is always present. It was signalized by Vieusseux and by Mathey, in the Geneva epidemic of 1805, by whom it was described as "acute" and "violent;" by North, in the same terms; by Fitch, as "a distressing heavy pain;" by Fiske, as "distress amounting almost to torture, particularly through the temples;" by Williamson, as so "excruciating" that the patient cries, "oh, my head! my head!" Fish uses the terms "sharp and lancinating" to represent this pain, which he adds, "is confined to a small spot sometimes;" Gallup speaks of it as being felt "in the forehead between the eyes;" Hale says, "that in a few instances it increased until it produced

delirium;" and Danielson and Mann refer to a child of fifteen months in whom the fontanelle opened during a paroxysm of pain. Ames includes in his graphic description all of these varieties in the seat and character of the pain. Equally characteristic are the terms used by European writers. Tourdes states that this pain "extorted cries and groans that could not be repressed;" it was throbbing, boring, or lancinating; sharp or crushing, "as if the head were in a vice, or nails or screws were forced into the brain." Even during partial coma the severity of the pain is sometimes attested by the contortions or cries of the patient, the movements of the head, or the manner in which the hands are raised towards it. It is generally described as persistent in a greater or less degree throughout the attack; but that this is not always the case, the recent epidemic at the Philadelphia Hospital proves, where not only this pain but those which usually accompany it, in the spine and limbs, were always mitigated, and generally removed, by means of cups, dry or scarified, according to circumstances, and blisters applied upon the nape of the neck. Yet in epidemics of a graver type the persistence of the symptom is most usual, even although the degree of its severity may not be uniform.

It is to be presumed that the headache, with such peculiarities as we have seen it to possess, ought never to be confounded with the constant dull and heavy pain in the head which is peculiar to typhus and typhoid fevers; on the contrary, we may reasonably conjecture that the material condition of the brain must resemble, not that belonging to the fevers named,

where no meningeal lesion exists, but that of the same organ when its membranes are inflamed by tuberculous or other deposits, or by traumatic causes. And such, it will be found, is the fact.

Vertigo is another symptom of the same class. In the New England epidemic of 1823, it was thus described by Miner. "In all the severe, and in a majority of the mild cases, there was *from the very access*, before a particle of medicine had been taken, a peculiar deficiency of vital energy in the brain and the whole nervous system, so that raising the patient into an erect posture, would generally produce the same sort of *vertigo*, anxiety at the stomach, acceleration and irregularity of the pulse, nausea, and even fainting, which result from a similar position after a great loss of blood." Ames refers to "excessive debility, *giddiness*, and dimness of sight," among the initial symptoms, but not as constant. This singular symptom attracted also the attention of Tourdes in the Strasburg epidemic of 1840–41. "Vertigo," he remarks, "was among the *earliest symptoms*. . . . Sometimes it confused the mind and rendered walking impossible. In two cases the patients were seized with a giddiness, which compelled them to whirl round, when they fell and did not rise again." Hirsch speaks of an adult patient, not yet confined to bed, who was suddenly seized with maniacal delirium, and such violent vertigo that he staggered about the room like a drunken man.

Debility.—"A great, surprising, and sudden loss of strength," North describes as "a constant and prominent symptom," and he adds, "syncope some-

times occurs." Hence the proposed name for the disease, "typhus syncopalis," or "sinking typhus." Miner speaks of it as occurring "in some degree in almost every instance" and as "sometimes constituting the first access of the disease," and describes it as "a death-like *sinking* sensation in the epigastrium." Fish says that "the strength of the patient, from the moment of the attack, was completely prostrated." . . . "The debility was astonishing and formed a striking feature of the disease." . . . The patient "found himself unable to raise his hand before he was sensible of being ill." The symptom had previously been described by Strong in nearly the same terms. "The pulse," says Foot, "was asthenic, and every symptom indicated a great and sudden prostration of the 'energy of the brain and nervous system.' . . . I have never witnessed a disease in which the powers of life are so suddenly and entirely prostrated." Tourdes mentions "a sense of lassitude as one of the initial symptoms." This was followed by convulsive phenomena, and then "a stage of debility in which the muscular power seemed annihilated," and if the patient reached convalescence he was "thoroughly exhausted, and required a long time to renew his strength." Neither vertigo nor prostration can, in themselves, be regarded as more characteristic of epidemic meningitis than of typhus and typhoid fevers; but their degree, the proportion of cases presenting them, and the uniformity with which they both, but especially vertigo, occur at the very commencement of the attack, in certain epidemics, are circumstances which have not been recorded of any epidemic of the two last diseases.

Delirium is described as a prominent symptom by all of the writers upon this disease, but it is also one which presents extreme varieties both in degree and kind. Sometimes it occurs among the first symptoms (North), but in the more regular cases it is not manifested until the second or third day. Strong refers to various degrees of mental disturbance, as mild, furious, hysterical and reasoning delirium. Haskell, Spooner and Holmes describe it as less frequent in males than in females, and in them as often being hysterical, a statement corroborated by later observations; and Bestor, on the other hand, describes cases in adult males "commencing with symptoms of violent insanity, and great muscular strength, the patient showing alternately signs of real madness and high merry delirium. I have known it require three or four smart men to take care of one of those maniacs." Fish states it to be of this description when it ushers in the disease, the patients sometimes being without sleep for a week, but adds, that when it "began at a later period, as it did in most cases, it was more mild, sometimes of a playful kind, the patient being sociable and humorous." Precisely similar conditions are described by Jackson and Warren, who also associate the occurrence of active delirium with severe pain in the head. Hale, indeed, regards pain as a cause of the delirium. Miner speaks of an extraordinary clearness of intellect as usually followed by delirium or coma, the former of which often resembled intoxication, or again hysteria. In the epidemic of 1823, this symptom was not very prominent. The same is also true of the greater number of

local outbreaks of the present epidemic. Thus during the winter of 1863, it is stated that among the cases that occurred at Sturgis, Michigan, "there was not complete delirium in any case." We may add, that in the recent epidemic at the Philadelphia Hospital, there were not more than two or three cases of maniacal delirium. But, to return to the history of this symptom. The epidemic of 1848, at Montgomery, Alabama, presented remarkable contrasts. Wild and furious as well as playful delirium, like that above described by Bestor, was observed; but the general tone of the mental aberration was desponding and apprehensive. The recent epidemic in Massachusetts exhibited equal varieties in the characters of the mental condition, but some degree of delirium was present in all of the cases.

If we turn to European histories of epidemic meningitis an equal and perfectly similar diversity appears. "It was rarely that delirium was absent" says Tourdes "during the whole of the attack. Most frequently it was transient; it ceased and was renewed, and it alternated with other symptoms, as pain and coma. . . . Sometimes, excited and furious the patients struggled with their attendants and endeavored to escape, sometimes vented themselves in complaints and groans, or incoherent words, and were restlessly active without any object; others remained sombre and silent." Several times the delirium merged into persistent monomania. In the epidemic of 1864, at Dantzic, the proportion of cases of violent delirium appears to have been unusually large. Gordon describes a case in which the patient "woke suddenly in the middle

of the night, delirious, began to hum tunes, to fancy that different people were conversing with him, &c."

Coma has been incidentally referred to as following delirium. It is met with sooner or later in nearly all fatal cases, but rarely in a marked degree until the approach of death. If anything is surprising in this disease, it is the absence of that deep and prolonged stupor which characterizes the typhoid state; although in some cases such grave lesions affect the brain upon both its upper and lower surfaces, and in others so profound a disintegration and devitalization of the blood has taken place that it exudes through the tissues as water passes through a porous body.

These different varieties and degrees of delirium are not absolutely peculiar to epidemic meningitis; they occur in typhus and in typhoid fever, but in the greater number of cases of those fevers the symptom is more constant and uniform, and of much longer duration, and is associated in general with a much more obscure and obtuse condition of the mental faculties. Another circumstance is in a great degree peculiar to epidemic meningitis. We have repeatedly observed it with surprise. It was noticed by Ames and other American writers, but it is best described by Tourdes, who says "it shows how profound the mental disturbance must have been, even where it was least exhibited. Most of the patients on recovering had totally forgotten the commencement of their illness. Many were astonished to find themselves in the hospital," &c. This complete loss of memory was observed in cases which had not presented such symp-

toms at the commencement of the attack as would explain its occurrence.

The FACIES, or expression of countenance in this disease is also peculiar. When pain in the head is severe and paroxysmal, the features are contracted and distorted in every manner that is indicative of severe suffering; when it is more persistent, the face assumes a fixed and rigid expression, or is at the same time dull, particularly after a long continuance of the pain has produced exhaustion. In the apoplectic form, *i. e.* with sudden or a very rapid loss of consciousness, the expression is said (Tourdes) to be fixed and stupid, like that of a person dead drunk; but such terms do not imply that the features are turgid and purplish. In this disease we observe neither the dark, dull, swollen and duskily flushed face of typhus, nor the languid, sleepy expression and circumscribed flush on the cheek which are so characteristic of typhoid fever. Except during absolute insensibility occurring in rapidly fatal cases—and even then the face is more frequently sunken than bloated,—there is a look of greater intelligence than belongs to the diseases mentioned, more mobility of the eyelids, more life in the eye, a less degree of decomposition of the natural expression of the features. Upon this very characteristic and distinctive facies Hirsch remarks, that the pale and sunken countenance at the beginning of the attack is altogether remarkable. Forget asserts that paleness of the face and skin generally was perhaps the most ordinary condition. So says Corbin, who observed it in eighteen out of twenty cases; and Mayne compares the ap-

pearance in the worst cases to that of cholera. Hirsch, also, adds, that the condition in question was observed by him, not in the gravest cases only, but in a considerable number of patients who were less dangerously ill.

Cutaneous Sensibility.—Hyperæsthesia of the skin is a symptom which, when it occurs, may be considered as characteristic of this disease, and as sharply distinguishing it from the two fevers with which it has been more or less confounded. Strong remarks, that "the nerves, in some few cases, had such a morbid degree of sensibility, as rendered the whole surface of the body sore to the touch." Tourdes remarked its presence even in those violent cases in which consciousness appeared to be extinguished. In many of such cases, however, it is quite possible that movements developed by reflex irritation were mistaken for proofs of sensibility. He states that "cutaneous sensibility was the last of the sensorial functions to be lost, and never until the immediate approach of death." In 1846, during the epidemic in Dublin, McDowel described the patients as being sore all over, and wincing upon the slightest touch, or refusing to change their position in bed, from the pain consequent upon the slightest movement. Burdon-Sanderson found it a very prominent symptom of the disease as it prevailed about the Lower Vistula; and Niemeyer, who also describes it, states, as Strong did long ago, that it is sometimes followed by cutaneous numbness or insensibility, which he ascribes to pressure upon the posterior roots of the spinal nerves by exudation matter. In many cases during the

recent epidemic we observed this symptom. It was often strongly marked upon the anterior surface of the trunk.

Pain in the Spine and Limbs is a symptom of the same origin as the one just considered, and is even more characteristic because more uniformly present. Among American observers, it has from the beginning attracted attention. North refers to violent pain in the limbs mounting up to the head, and often followed by numbness of the extremities. Fiske describes it in a passage, which deserves to be quoted in full: "Its bold and prominent features defy comparison. . . . In some, a pain resembling the sensation felt from the stinging of a bee, seizes the extremity of a finger or toe; from thence it darts to the foot or hand, or some other part of the limbs, sometimes in the joints, and sometimes in the muscles, carrying a numbness or prickling sensation in its progress. After traversing the extremities, generally on one side only, it seizes the head, and flies with the rapidity and sensation of electricity over the whole body, occasioning blindness, faintings, sickness at the stomach, with indescribable distress about the præcordia; a numbness or partial loss of motion in one or both limbs on one side, with great prostration of strength. The horrible sensation of this process no language can describe." In equally precise terms it is mentioned by Fiske, Jackson, Gallup, Hale, of the earliest, by Ames and others of the middle period, and by Lidell, Armstrong, Borland, Baldwin, Parks and others of the most recent epoch of the prevalence of the disease in America. Quite as prominently it appeared in all of the European

epidemics and sporadic groups of meningitis. Thus Curry described it in the cases he observed in 1806, in England; Gaskoin, in the Portuguese epidemic of 1861–62; Tourdes, in France, in 1841; and all the historians of the recent outbreak in Germany. The pain most frequently begins, and generally is most severe in the neck, but sometimes extends to the whole length of the spine. It may last throughout the disease, or be limited to its early stage, or again it may persist even after convalescence. Our own observation has furnished many cases of extreme suffering from the symptom here described, but none in which it was not relieved by appropriate treatment. Tourdes speaks of the spinal pains, associated as they are in this disease, as the true pathognomonic sign of cerebro-spinal meningitis. They usually occur in connection with neuralgic pains in the extremities; but either may be present without the other, and, of the two, the pain in the spine is the more frequent. It may not be superfluous to mention that whatever the seat of the spinal pain, it is generally aggravated by pressure.

Tetanoid Phenomena.—These are still more characteristic of epidemic meningitis than the symptom just described, although both originate in the same spinal lesions, congestion of the membranes of the cord, or its compression by an effusion either of serum or of lymph, or by changes in its proper tissue. These lesions will be described hereafter; we recall them at present to keep in mind that only true idea of the disease which embraces the reciprocal relations of its symptoms and their material causes. Tetanoid symptoms are by no means necessary to

constitute a characteristic picture of the disease. Their presence unequivocally denotes the existence of spinal lesions; but the converse of this proposition is far from being true. There may be almost any grade of meningeal spinal inflammation without muscular rigidity. In this, as in other cases, the degree of irritability of the affected part is just as important an element in developing functional phenomena, *i.e.* characteristic symptoms, as are the material tissue changes of the part itself. Both factors must coöperate to produce the result. Hence it is that in some epidemics the symptom is present in a small proportion only of the cases, even of those patients in whom characteristic lesions of the cerebro-spinal axis are found after death. This fact was repeatedly observed in the recent epidemic at the Philadelphia Hospital. A want of absolute uniformity in the occurrence of this symptom has led to various extravagant notions which have prevailed in regard to the nature of the disease, and to doubts, entertained even by some enlightened judges, of the true character of certain epidemics of meningitis, especially in its early history in this country. A more thorough study of them, however, and particularly a comparison of cases occurring in different localities, and in successive years, removes all doubt upon the subject, and proves the unity of the affection beneath its diversified phenomena.

Thus, in one of the earliest histories of the American epidemics, that of North, we find among "the more unusual symptoms," "a drawing back of the head, with a kind of clonic spasm of the muscles of the neck" and a "corpse-like rigidity of the limbs."

But for this brief statement we might almost feel uncertain whether the disease described by himself and several of his cotemporaries was really epidemic meningitis. Fortunately, other testimony which is equally emphatic, remains. Thus, Lyman says, there is "pain and rigidity of the muscles of the neck, often, and the head is in many instances inclined backward;" Woodward describes the "head drawn back with spasm;" Jackson says the "head is sometimes drawn back as in opisthotonos," and Gallup states that "the form of tetanus, called opisthotonos, comes on sometimes towards the close of severe cases." To this point the testimony of Strong is very pertinent: "During the first two years," he remarks, "the extensor muscles of the head and neck, were, in almost every case, affected with true spasm. . . . This symptom, however, disappeared with the petechial spots, and during the last two years was rarely observed." In an epidemic which prevailed in the Valley of Virginia, in 1812–13, Dunbar described "the head as drawn back, and the spine curved rather more than even in the worst cases of tetanus," at the same time that "petechiæ and vibices appeared generally over the body." Hazeltine, also, in his account of the epidemic which he witnessed in York, Massachusetts, between 1810 and 1815, says, "there were, in some cases, great rigidity, immobility and soreness of the limbs and surface; spastic rigidity of the muscles of the lower jaw and the posterior muscles of the neck." In all of the fatal cases petechiæ and vibices were observed. It is evident, therefore, although certain historians of the first epidemic in this country omit all mention of

this symptom, that others observed and recorded it, which positive testimony outweighs a whole volume of negative evidence, and establishes the nosological character of the epidemic in question. As we shall see hereafter the anatomical proofs are similar, and equally strong.

When the epidemic began in the Southwestern States of the Union, it was, as elsewhere, a strange visitor, and gave rise to the usual confusion between it and the ordinary local diseases. In New England it was confounded with "typhus," in the South with malarial affections. When Boling first described its appearance at Montgomery, Alabama, he committed this error, but he did not fail to mention the characteristic phenomena of the disease, so that its nature cannot be doubted. Very possibly, however, its type was modified by malarial agencies. However this may be, he says, "after a few exacerbations of fever, suddenly and unexpectedly, at the period of an approaching paroxysm spasms resembling those of tetanus supervene. . . . The muscles of the abdomen, of the neck and jaws, and of the superior extremities, after the commencement of the spasms, remain generally in a firm and rigidly contracted state. Those of the neck were in two instances affected, as the spine was bent and the head drawn permanently back as in opisthotonos." So, in 1847, Drs. Hicks and Taylor, of Whitesville, Tennessee, describe as sometimes an initial and sometimes an advanced symptom, "rigidity of the posterior cervical muscles, retracting the head considerably backward, as in tetanus;" so Dr. Chester, of Union county, Arkansas, mentions

opisthotonos in all of the four cases reported by him in 1847; so Dr. Love, describing several forms of the disease, as it occurred in a regiment of Mississippi volunteers, at Vicksburg, in 1847, refers to one in which furious delirium ushered in the attack, and adds, "these cases were always attended with opisthotonos of the muscles of the neck;" and, finally, as regards the same epidemic, Dr. Ames, in his well known and model essay on the subject, dwells upon the tetanic symptoms exhibited, the continued opisthotonos, or the retraction of the head, merely, which took place in a very large proportion of the cases, while many other patients were affected with stiffness and soreness of the back. In a few cases the affection was confined to the sterno-mastoid muscles of one or both sides; and in others the head was held stiffly and not inclined forwards or backwards.

During the next epidemic this symptom was equally characteristic wherever the disease was carefully observed. In 1857, says Dr. Kendall, of Onondaga county, New York, "others lie in a torpid state, the head drawn back upon the nuchæ." In the same year we find that, in Chemung county, New York, the disease prevailed, and out of the forty-three cases of it reported by Dr. Squire, only three presented tetanic phenomena. Two of these, which proved fatal, were examined after death, and a purulent exudation was found in the one, and congestion only in the other, although muscular rigidity during life had been equally manifested in both. During the same period, in Madison county, New York, Dr. Saunders observed among the usual symptoms "contraction of the muscles

of the back and back of the neck, not unfrequently producing complete opisthotonos."

The last epidemic furnishes evidence of precisely the same kind. Dr. Upham says, "the decubitus was mainly on the right side, with the head not unfrequently thrown back—the neck rigid and stiff—a partial opisthotonos." Dr. A. P. Woodward illustrates a proposition already laid down by us, in a case in which there was *no* opisthotonos, although the exudation upon the brain and spinal marrow was singularly profuse. Not to multiply citations, we may add that the symptom is prominently described by Drs. Frothingham, A. T. Watson, W. H. Draper, E. W. Jenks, and J. K. Reid, who found it in every one of ten cases; F. B. Poley, J. L. Oliver, W. Anderson, and C. G. Page, in eight out of seventeen cases; M. Kempf, J. H. Hutchinson, and W. G. Armstrong, of Mobile, who speaks of tetanic rigidity of the cervical muscles with pain in the head and neck as the most prominent and almost universal symptom; W. O. Baldwin, of Montgomery, Alabama, J. W. Moorman, of Kentucky, and Dr. O. B. Fassett, of Vermont, who made the same observation in the epidemic of 1864; and, finally, Dr. Parks, analyzing the results of observation in Massachusetts, finds that out of 261 cases severe opisthotonos existed in 107, slight in 80, and in "nearly all" of 26 cases; so that the symptom was absent in only 48, or in less than one-fifth of the whole number.

European epidemics of meningitis have exhibited, even still more uniformly than our own, the distinctive phenomena of spinal irritation. It was observed, but only in a few cases and not in an aggravated form,

during the Geneva epidemic of 1805, and still more slightly in the local outbreak of the disease at Ashburton, England, in 1807. At Naples, in 1833, De Renzi found it "frequently." In his account of the epidemic of 1842, at Strasburg, Tourdes says, "the decubitus of the sick was distinguished by a backward flexion of the head and spine; most frequently the neck alone was affected, but sometimes the whole trunk was arched." "This symptom was exhibited only after the disease had reached a certain degree of development, and remained until death in fatal cases, and in others so long as the general symptoms continued grave. From time to time it underwent remission or exacerbation, or alternated with convulsive movements, after which the trunk resumed its arched position. . . . Muscular contraction with rigidity was sometimes partial and local, and sometimes general. In some cases it affected the flexors of the upper extremities. Trismus was also observed, but only in fatal cases." The manifestation of this symptom is well described by Gillkrest in his history of the Gibraltar epidemic of 1844. In Leipsic, in 1851, Wunderlich found opisthotonos in all of his cases. Niemeyer, in 1865, stated that during the epidemic in Baden, "this symptom was wanting in extremely few cases." In some that terminated fatally it ceased a short time before death, but much more generally it persisted as long as life lasted. In one case it continued for more than two months, and in another until death on the forty-ninth day. The testimony of Hirsch is to the same effect. During the epidemic about the Lower Vistula, Dr. Burdon-Sanderson ob-

served this symptom in a modified form. The head was thrown back as if to alleviate the muscular spinal pains, and it was only when attempts were made to draw the head forward that the muscles became rigid, and even then less firmly than in tetanus. Among the sporadic cases occurring in London, in 1865, this symptom was observed by Drs. Ogle, Martin, Simon, and others. In the recent Irish epidemic a case occurred to Gordon, of which he says: "The patient lay on her abdomen, and refused to allow herself to be moved on her back or on either side. Her spine presented a most wonderful uniform curve concave backwards; her head was also curved backwards on the spine of the neck."

Tremors and Twitching of Tendons, so common in typhus, are much less frequent in this affection; indeed many cases do not present them at all.

Clonic Spasms, or convulsions, although less common than rigidity of the muscles, have also been frequently observed. They were seen especially in children, by Vieusseux, described by Mathey, Danielson and Mann, Fitch, North, Miner, and many others. Forget pictures the violent agitation of some patients produced apparently by extreme pain, and also speaks of the "wretched spectacle presented by young men, who but a short time before were full of health and strength, struggling desperately in frightful convulsions which were the mournful harbingers of inevitable death." This statement does not imply that convulsions, even when general, are necessarily fatal, for they often occur at the commencement of the attack in patients who recover. They vary in degree from

subsultus affecting particular muscles, as of the eyes, the face, a limb, &c. to general and epileptiform convulsions with loss of consciousness, and may be associated with paralysis of other parts; as where the two halves of the body are affected with the opposite conditions.

Paralysis, or loss of muscular power in different degrees, has also been repeatedly met with, but less so than abnormal muscular contraction. North observed paralysis of the arm or leg, or of both at once, the latter occurring among the initial symptoms of the attack: to this statement Jackson adds paralysis of the muscles of deglutition. At Gibraltar, Gillkrest met with two cases of temporary hemiplegia. In 1865, a man was ill of the disease, in Dublin, of whom Dr. Law says: "all his members seemed to be paralyzed; he could move neither arms nor legs." A remarkable case is recorded by Wunderlich, of a man who, on the second day of the disease, lost both sensibility and motility in the lower limbs and over the greater part of the trunk, while the left arm was also partially paralyzed. Yet he did not die, and five months afterwards had partially regained his muscular power. The persistence of the paralysis in this case is very remarkable. More frequently, if the patient survives, the loss of muscular power or of sensibility is temporary, continuing only for a few days or weeks, and indicating therefore with probability that the paralysis resulted from pressure on the nerve roots or centres and not from interstitial lesions. Perhaps it will be thought not improbable that the sudden or rapid and extreme prostration which occurs in many

cases of epidemic meningitis, and sometimes in all that arise in a particular locality, may be due to the congestion or the serous effusion which precedes or takes the place of fibrinous exudation. That it is not due to the blood, or at least not to the condition of it which exists in typhus, is shown by the abscence of the peculiar stupor which belongs to that disease. The prostration referred to acquired for this affection the name of "sinking typhus," and is well described by Miner, who particularly attributes it to a want of nervous power transmitted through the par vagum. Our present knowledge of the nature of the anatomical lesions in the disease would seem to justify an explanation of these symptoms by the pressure which the congestion, effusion or exudation exerts upon the origin of the pneumo-gastric nerve which associates the actions of the lungs, the heart and the stomach.

SYMPTOMS FURNISHED BY THE ORGANS OF THE SENSES.

The Eyes.—Abnormal conditions of these organs and of their functions are among the most striking, and, when they exist, distinctive phenomena of epidemic meningitis, and add one more to the many striking contrasts of the disease with typhus and typhoid fevers. In the former of those affections a dark or dusky, almost purplish, color of the eye, with a watery condition of the conjunctiva, is a common and characteristic phenomenon. But it is totally unlike the appearance of the eye in epidemic meningitis.

In typhoid fever the eye is occasionally red, and of a lighter tint than in typhus; but this symptom is not uniform, is not even common, and the redness, when it does occur, is rather striated, while in the disease before us it is generally diffused and uniform. It has been observed in all epidemics of meningitis; in some of them characterizing every case, in others occurring more or less frequently. In the recent epidemic which we witnessed it was scarcely ever absent. Strong speaks of it as "a peculiar redness of the albuginea." North describes it as "redness or suffusion;" Ames says, very clearly, "in a few cases, principally among children, the conjunctiva has a pinkish tint, when there were no distinct vessels to be seen;" in one of Curry's cases "the tunica albuginea was completely suffused with blood." In the epidemic described by Tourdes, on the other hand, it was seldom observed, except as a symptom of conjunctivitis with mucous or muco-purulent secretion, and a similar observation has been made by other historians of the disease, too numerous to mention. While writing these pages, (June, 1867,) we visited a young lady of twenty-four, who presented the peculiar redness of the eye of which we have spoken. Two evenings previously she went to bed perfectly well, and was awaked about midnight by a violent frontal headache accompanied with bilious vomiting and severe pain in the back, but only in the loins. There was said to have been at the same time chilliness and fever. On our visit the skin was cool, the pulse feeble, and about 60; the mind clear. On inquiry, assurance was given that the skin presented no discoloration; but struck

by the sudden onset of the illness and the peculiar appearance of the eyes, we urged an examination of the body, when the chest and upper portion of the abdomen were found covered with light red or pinkish spots of irregular form and unequal size, disappearing upon pressure. Within five days from the commencement of the attack, the eruption, the injection of the eyes, and the headache had vanished, and the pulse, which had risen to 70, was of good volume and strength. Among recent authors, Gordon states that the conjunctivitis is sometimes severe, with a profuse purulent discharge. But much more alarming and serious affections of the eyes are frequently observed, some of which are transient and others permanent.

Double and even Triple Vision, was noticed by North, and has been observed by many others since his time, its cause being, doubtless, the strabismus which is also a frequent incident of the disease. Jenks mentions a case in which it continued after recovery from the other symptoms; Armstrong met with it in several cases, affecting one or both eyes; Gillkrest found it not unfrequent; Banks met with divergent strabismus, as did others, including Burdon-Sanderson, who observed twelve cases of squinting. In seven the affection was transitory, not lasting more than a few days; in three cases it lasted from one to five weeks or more. In the epidemic studied by Tourdes, on the other hand, this symptom was quite uncommon.

Blindness has also been repeatedly observed. Fish states that in a few instances it was the first deviation

from health, and was generally followed by raving delirium. It was sometimes attended with general "numbness" or partial anæsthesia, and when this condition was extreme, blindness, with dilated pupils, quickly succeeded. In some cases sight was restored in a few hours, in others after a few days; but in no case was it permanently lost. This very brief duration of blindness is also noted by Ames. Jenks, however, refers to an example of the permanent loss, by amaurosis, of one eye. Lente reports a case in which several months after the attack, the conjunctiva was much injected, the globe shrunken and soft, the cornea hazy, and the lens cataractous. Similar cases, but of a more rapid course with entire destruction of the eye are referred to by Love. In Europe analogous statements are made by Gillkrest, Ziemssen, Corbin, Wilson, and others.

Inflammation of the Iris or of the Conjunctiva was frequently observed by Love, Upham, Jenks, and others, in the United States, and by Tourdes, Lionnet, Niemeyer, Wilson, and many more, in Europe. Niemeyer regards all these various affections of the eyes as consequences of inflammation of the neurileme of the trunks of the nerves which supply the eyes. He calls attention particularly to the analogy between the various destructive lesions involving the eye in this disease,—the purulent ophthalmia, the softening of the cornea, and hypopion,—and the changes produced in the organ by the destruction of the Gasserian ganglion. It seems probable that in some cases superficial ulceration of the cornea may be owing to its exposure to the air in consequence of

paralysis of the orbicularis muscle. Burdon-Sanderson gives as the results of ophthalmoscopic examination in some cases of consecutive blindness, opacity of the vitreous humor, synechia posterior, &c.

The PUPIL has always been observed to vary in shape and size in this disease. North and Strong mention its alternate contraction and dilatation, and Danielson and Mann say "the size of the pupil varies suddenly, from almost wholly obliterating the iris down to the size of a millet seed, and then again as suddenly dilating." To this Fish adds, "in some cases this alternate contraction and dilatation continued for an hour or two, when it disappeared; being succeeded by a more natural state of the eye, or permanent dilatation with coma." Ames says, "the pupils were dilated in seven out of forty-one cases; in the rest they were either contracted or natural;" while Armstrong found them dilated in a majority of cases, and sometimes one pupil was contracted and the opposite one dilated. In Europe Tourdes observed dilatation most commonly; Gillkrest, oscillation; according to Burdon-Sanderson contraction of the pupil was most common at the commencement of the attack, even when the patient was more or less stupid, but dilatation took place when he was roused in any way. Such alternations of size, however, were observed independently of all apparent cause. In cases of long duration with great exhaustion "the pupils were almost invariably dilated." Photophobia is not uncommon, (Ames refers to six cases of it); and occasionally spasmodic movements of the ball have been witnessed.

HEARING.—Fish observed that hearing and smelling were natural; but some patients lost their hearing, when recovering, "without any perceptible injury about the ear." Strong refers to three such cases. Jackson and Warren state that "in a small number of cases the disease has been followed by deafness, from which the patients have not speedily recovered;" in a few instances "purulent discharges from the ears have been noticed." Ames noticed "spontaneous deafness in a few patients," and other cases in which there were temporary exacerbations of deafness. Sometimes, also, purulent discharges from the nose took place; and in one case the sense of smell in one nostril was lost. The loss of hearing is stated by Draper to have been observed at Carbondale. Wunderlich noted it at Leipsic, and Burdon-Sanderson about the Lower Vistula. The last mentioned reporter met with it in ten cases, of which three were patients under ten years of age, the rest between ten and seventeen. In six of them the affection appeared during the first few days, and in three during the second week. In one case it was not observed until the fourth week. This symptom appears to depend chiefly upon the pressure of the plastic exudation in which the auditory nerves are imbedded.

Finally, as regards the PHYSIOGNOMY, it may be stated that its expression is, from time to time, as different as the conditions which have now been described. Although it may vary as much as the look of maniacal fury does from that of profound stupor, yet it must be said that its average condition does

not indicate either excitement or coma, or even a great degree of dullness. The patient moves his eyes more briskly than in the two forms of fever several times referred to, and winks their lids in a manner quite unknown in those affections.

SYMPTOMS PRESENTED BY THE DIGESTIVE ORGANS.

The TONGUE presents no characteristic appearances. Miner said long ago: "on the whole, the state of the tongue was of very little service in diagnosis or prognosis." He and other writers describe nearly every possible aspect of this organ as regards moisture, dryness, and the color and consistence of its coating. But all agree that it rarely grows very black and dry, and that this condition, when it does occur, is not of long continuance. North speaks of "a bloodless appearance" of the tongue as "a certain token of approaching death," and Fish expresses a similar opinion. Our own observation in the recent epidemic showed that the tongue was generally moist, whitish in the centre and at the tip and edges. In a comparatively small number of cases it was dry, and more or less brown. The fuliginous condition of the tongue, gums, cheeks and lips, so common in typhus and typhoid fevers was not observed in any case.

NAUSEA AND VOMITING are very constantly present among the initial symptoms. In yellow fever, periodical fevers, and typhoid fever, they occur as the direct effects of gastric irritation; in typhus they are rarely met with, and then as a remote consequence of cerebral disturbance. In the present affection they

are evidently of a similar origin. But as the cerebral lesions here are more considerable and constant, the symptom, as might be expected, is more uniform and severe. Wherever the disease has prevailed it has attracted attention. North describes "sickness at stomach and vomiting;" Danielson and Mann "nausea and puking, the matter discharged from the stomach having no unusual or morbid appearance;" Fitch, Woodward and Haskell describe the symptom in analogous terms. The terms employed by Fish in regard to it are similar to those previously used by Strong, and are worthy to be recalled as indicating its cerebral origin: "the affection of the stomach is not easily described. . . . Some called it a faintness; some a coldness, others a deadly feeling. . . . Nausea and vomiting were general, and in most cases violent. . . . In a few instances vomiting was the first symptom that indicated disease." It is emphatically referred to by Jackson, and both he and Fish state that bile was rarely vomited during the first few weeks of the epidemic. But at all periods there were some patients who threw up a dark green or bluish liquid. Gallup alludes to cases in which the vomiting was incessant and very copious; and he as well as others speak of the regurgitation rather than the vomiting, of large quantities of liquid. In a few cases the ejecta "resembled black vomit." Perhaps these were the same as the bluish matters referred to above. In other cases the liquid was rather white and viscid, resembling mucus. Hale furnishes a similar statement, and also says that "nausea and vomiting were nearly universal at the commencement of the fever, in every

stage of progress of the epidemic." "It often lasted six or eight hours, and sometimes for two or three days." "It was often excited by the patient's suddenly raising himself up," thus denoting its cerebral origin. Miner, indeed, says "vomiting or nausea, in this disease, seemed ordinarily to be entirely symptomatic of an affection of the brain." In the epidemic of Montgomery, Alabama, (1848,) this symptom was frequent, but less constant; Kendall, of Onondaga, New York, (1857,) speaks of it as constant and distressing; and in 1863, it was an initial symptom during the epidemic at Newbern, North Carolina. It was equally constant and characteristic in European epidemics from that of Geneva to the present time. Tourdes states that nausea and vomiting almost always attended the onset and the first stage of the disease; describes the vomited matters as a greenish bilious liquid; and adds, as we have said had been done by others, that the vomiting cannot be regarded as primarily gastric, that "it is without doubt a sympathetic phenomenon occasioned by the cerebro-spinal affection." "Vomiting of food, with bilious matters, often green," was observed by Gaskoin, in Portugal, and by Burdon-Sanderson at Dantzic. Niemeyer gives similar testimony, and dwells on the sympathetic character of the symptom, but thinks it less urgent and persistent than in tuberculous meningitis. Hirsch states that in eight of thirty-nine cases there was no vomiting, and in four only retching, yet speaks of it as one of the first and most constant symptoms; notices the important fact that it often occurs without any previous nausea, and, like others, maintains that

"its sympathetic character does not admit of any doubt."

In some epidemics, or in isolated cases, *diarrhœa* has accompanied the vomiting, and many writers describe the conjoined symptoms as a cholera morbus; but the painful spasmodic character of that affection is wanting. Tourdes found this symptom in a large proportion of cases which survived the sixth or seventh day. But when it is known that the treatment he employed consisted, *inter alia*, of purgative enemata, calomel, jalap and croton oil, the peculiar occurrence is no longer surprising. If any symptom, without being characteristic, is yet almost uniformly present, in this disease, it is *constipation*. In this respect it resembles other forms of meningitis. "The intestines were not disordered, except from torpor," says Fish; "the bowels are commonly "quiet" says Jackson; "the intestines," writes Gallup, "are as little affected in this disease as the head is in dysentery." The bowels are mentioned by Hale among the organs "that continued to perform their functions with nearly the same regularity as in health." . . . "There was much more often a tendency to costiveness than to diarrhœa." "The bowels were either natural or constipated" says Ames; and Hirsch found them to be so in all of sixty cases observed by himself.

The *appetite* is naturally, and, as it were necessarily, impaired or quite lost during the painful stage of the disease, but once this period has passed a desire for food is generally exhibited. Fish thus alludes to the symptom in question: "The appetite is diminished, but it is not always so entirely destroyed as in most

other acute diseases. Children particularly sometimes express a strong desire for food." A similar statement is made by Jackson, and by Hale, who also says, "some patients would take food in considerable quantity, with almost as much relish as in health." "No sooner is the violence of the disease abated" says Strong, "than the appetite generally returns, and the stomach craves, receives, and digests animal food with great freedom and without any ill effect." Tourdes states that "a premature desire for food was generally remarked; the patients, even while in imminent danger, clamored for food and endeavored to procure it. Digestion was easy, but the restoration of flesh and strength was by no means proportioned to the reëstablishment of this function." It need scarcely be remarked that these conditions of the appetite contrast very strongly with such as are common in typhus and typhoid fevers.

It is very noticeable that, as Jackson remarks, "there is seldom any remarkable *thirst;* in a few cases it has not been at all greater than natural." An apparent contradiction to this statement is given by Hale, when he says "the thirst was extremely urgent." But he immediately adds that it was "peculiar in its nature." It was not a desire for "cool and acid drinks," which, "except in a few instances were disagreeable, and those which were warm and aromatic were demanded in their stead. . . . Their aromatic quality seemed to operate like a cordial, to remove the sensation of depression, which was constantly felt at the stomach." Tourdes states that "thirst was slight and appeared late; in only

two cases did it exist at the commencement of the attack." And such is the general testimony upon this point. But it is not without exceptions. In the recent epidemic in the Philadelphia Hospital, the patients were clamorous for fluids.

In certain of the early American, and in some other epidemics, *sore throat* is mentioned among the symptoms. North found it an almost constant premonitory indication; Fish states that "some patients complained of a sore throat, which, on examination, presented the same appearance as in cynanche maligna, except the swelling of the tonsils." Jackson, referring to such cases, remarks that "the fauces are found very red, but not swollen in any part." Hale adds that sometimes there was "a swelling and inflammation of the gums and fauces, which was accompanied with partial salivation." Among European observers, Levy is the only one, as far as we know, who mentions any similar condition. He speaks of a thin pearl-colored, or whitish band upon the gums, which, in one case, invaded the fauces.

Aphthæ have occasionally been met with; and both American and European reporters mention the occurrence now and then of swelling of the *parotid glands*. Jackson refers to it as "slight." Jenks saw "swelling of the cervical and submaxillary glands in one fatal case." For ourselves, we met with two or three cases of suppurating parotids in the late epidemic. Tourdes observed parotitis in two fatal cases; and Hirsch ranks this affection among the rarer accidents of the disease.

THE URINARY ORGANS, JOINTS, AND RESPIRATORY APPARATUS.

The *urinary organs* have not exhibited any characteristic or uniform phenomena in this disease. Sometimes the flow of urine has been diminished, sometimes profuse. From the beginning of its history cases of retention, and sometimes of incontinence of urine have occurred, and others of dysury. Some of these have evidently been due to an impaired muscular power in the bladder, others to a blunted perception in the nervous centres, and others probably to the influence of cantharides absorbed from blistering plasters. The *urine* has been found, in some cases, to contain albumen, in others cylindrical casts, or blood corpuscles. These deposits have sometimes occurred when blisters had not been applied. Hirsch, Greene, Morland and others report cases in which albumen existed, or there was a phosphatic deposit, while the chlorides were diminished. In one case the urine contained albumen, granular casts, and pus cells, but no urea could be detected in it.

The condition of the *joints* illustrates the predominance of the blood element in some cases. In the Report of Jackson and others, it is said, "In some cases swellings have occurred on the joints and limbs. These have been very sore to the touch, and their appearance has been compared to that of gout. The parts so affected feel as if they had been bruised. These swellings arise on the smaller as well as on the larger joints, and are often of a purple color." Gallup says "the joints are sometimes affected with

swelling and extreme soreness, resembling rheumatism, but not attended with so much swelling." Upham mentions "synovitis" as an occasional incident of the disease; and Niemeyer remarks that "inflammatory effusions in the joints which were frequently observed in France, were not entirely wanting in the epidemic of Rastatt." In one case various joints of the upper and lower extremities were moderately swollen and exceedingly painful when handled. Effusion, without redness, affecting the knee joint was observed by Gordon.

Respiration.—Jackson reports that it was much and variously affected; but, in general, difficult. Tourdes states that it was sighing, labored, and interrupted. Burdon-Sanderson says "its embarrassment was marked by a slow labored inspiration, followed by a quick inspiration and a long pause." In fatal cases the approach of death was often denoted by gurgling rhonchi, due to a serous effusion in the air-tubes. Pneumonia is not a very unusual accompaniment, of which we have seen several examples. The suspirious and interrupted respiration just referred to is of the same character, but not so marked, as in tubercular meningitis. It is most distinct in cases which present tetanic symptoms, paralysis, and other evidences of central cerebral compression.

SYMPTOMS FURNISHED BY THE PULSE.

In the last named author's history of epidemic meningitis, it is said to be quite impossible to establish a rule for the variations of the pulse in fre-

quency, and that it can only be stated, in general, to be small, thready, weak, and intermittent in cases tending to a fatal issue, and especially in those which rapidly run to such a termination. Only in rare and altogether exceptional cases is it full and tense. Moreover, its rate and other qualities are subject to repeated and often inexplicable variations. These general statements are borne out by the authors to whom we shall now refer.

North declares that "increased frequency of the pulse" is not "a prominent symptom of this disorder." Fish says "the pulse was always extremely weak, feeble, and depressed: in most cases more frequent than in health; in others it was imperceptible on the attack, and until it was restored by stimulants. There was not, before or after the chill, any increase of arterial action; on the contrary, where the disease was left to its own course, the pulse grew more feeble until death took place. In some instances, though rarely, in fullness and frequency it did not vary from a healthy state." Jackson, besides the characters just described, remarks that the pulsations "are remarkably variable, so that in the course of an hour, and indeed in much less time, they change from quick to slow, and from strong to feeble, and vice versa." Gallup confirms these statements, adding, that "in fatal cases the pulse increases in frequency until nothing but a faint, tremulous, retiring motion is felt." A remark of this author is confirmed by Hale, viz., that in a certain number of cases the pulse is at first full and hard. Miner reports that, during the epidemic he described, "every variety of pulse oc-

curred, except the strong and hard, and this often in the same patient." In many mild cases, and in most of the others, until the period of fatal sinking, it was rarely so frequent as in health. It also, sometimes, from being preternaturally slow became very rapid, rising from forty, or even twenty-seven, in a minute, to a hundred and thirty. Nor was this sudden change always a fatal sign. Muscular exertion, rising from the recumbent posture, &c. sometimes doubled its frequency, besides producing considerable irregularity. Some fatal cases were attended with distressing palpitation of the heart. Not to prolong these citations, however important they may be for exhibiting the peculiarities of the disease, we will simply add that substantially the same account of the pulse is given by Kendall, Jenks, Armstrong, Morland, Githens, and other American observers, and by Mathey, Tourdes, Gillkrest, Lionnet, McDowell, Gaskoin, Law, Gordon, Wunderlich, Niemeyer, and Burdon-Sanderson, among European writers. Diminished force, and volume, and a tone so much impaired that slight causes produce extreme variations in its rate and rhythm, are, therefore, the characteristic qualities of the pulse in this disease, and those by which it is distinguished from the fevers to which it bears a superficial resemblance.

SYMPTOMS FURNISHED BY THE SKIN.

The condition of the *skin* as regards *dryness and moisture* is various. Jackson states that, "in the early stages the skin is perhaps invariably dry; at a

later period spontaneous sweats have broken out on the head, chest, and superior extremities." On the other hand, Fish declares that "it was very difficult to excite a sweat or preserve a moist skin after it had been procured." Hale says that the skin "was moist and rather inclined to profuse sweats." He however seems to refer to the effect of diaphoretic measures rather than to spontaneous perspiration, for he adds, "after a diaphoresis was once produced, if the measures which caused it were pursued with the same vigor, it ran into a profuse sweat." Any one who is acquainted with the violent measures then employed for the purpose, will feel no surprise at the result. Yet Miner, who condemned such treatment, points out the fact that although the skin "was seldom much inclined to spontaneous moisture, there was in a few instances a morbid drenching perspiration." Precisely similar observations were made during European epidemics, as Hirsch relates.

Temperature.—Conditions of the pulse such as have been described would hardly be compatible with an uniformly high temperature of the skin, and, indeed, the variations are equally striking in both. As the pulse never acquires the force and sustained frequency which belongs to it in pure inflammations or in idiopathic fevers, so the heat of skin is always less than in those affections, and is constantly undergoing vicissitudes such as are observed in no other disease. The early remarks of North upon this subject have been too little heeded. Speaking of frequency of pulse and heat of skin as involved in the definition of fever, he adds, "neither of these are prominent

symptoms in the disorder. Cases occur, it is true, in which the temperature is increased above the natural standard, but these are rare." In relating a case, also, he remarks, "her heat, as often as it was measured, was found natural; pulse eighty." According to Strong, "a *diminution of heat* may be considered as among the most striking symptoms of this disease." . . . "In more than a hundred cases there were few in which the heat was up to the natural standard, and rarely any in which it was above." Foot says, "the degree of heat rarely exceeded the healthy standard, and fever constituted a very inconsiderable item of the complaint." Fish states that "sometimes the skin was of a natural temperature, but more generally it was below it;" Gallup mentions coldness of the skin at the beginning of the disease, but adds, that in the act of sweating a high heat was sometimes observable. During the early part of the epidemic of which Hale records the history, he found "the skin dry and parched," but "the limbs often cold and numb;" and at a later period the initial coldness persisted until it was dispelled by external means. Miner, writing of the epidemic of 1823, states that "in almost every case the skin was preternaturally cool for several of the first days, and subsequently, in temperature, *it never exceeded the standard of health* in more than three or four cases. . . . Sometimes, though rarely, the patient would complain of a general sensation of heat, though to the feel of the attendants, he would be actually cold. . . . If increased heat and increased frequency of the pulse are a part of the definition of fever, *a great majority of the patients had no fever at*

all." Jenks says that "the heat of the surface was less in all cases than is usually observed in acute diseases." In forty-two cases, with dry skin, Ames found that "the natural temperature preserved in fourteen, the heat was below the normal standard in seventeen cases, and above it in eleven.... There was never any pungent heat in the skin; in the greater number in which it was above the natural temperature, it was still below ordinary febrile heat." And, finally, as regards American testimony, we may add that the conditions above described were all represented in the cases of the late epidemic at the Philadelphia Hospital. The calor mordax which, the year before, had been so prominent a symptom in the typhus epidemic, was no more met with, and the thermometrical observations of which Dr. Githens has furnished an account, prove that the temperature of the body in this disease is lower than that recorded of any other fever or inflammatory affection. The highest temperature in different cases varied between 100° and 105°, while in two cases it was below 100°.

In European epidemics the same conditions of the bodily temperature were observed. Tourdes describes them very distinctly in the following passage. "At the onset there was no fever, even when the pulse was accelcrated. The temperature of the skin was natural or sometimes even lowered; and there was always a complete absence of fever in cases which terminated fatally within the first few days. But when the attack was of more than a week's duration, a true fever was lighted up which remained until convalescence or death. This fever was of the continued type,

but presented marked and regular exacerbations, which took place in the afternoon along with an aggravation of the other symptoms. The form of the fever was sometimes, although rarely, inflammatory; more generally it was typhoid." Gillkrest states that "a high febrile movement took place only in a limited number." Lionnet says that the skin "rarely felt hot." The following observations, if not more positive, are, at least, more precise. Niemeyer calls attention to the very slight increase of temperature during the first and second days of the attack, viz. to 101°—103°. In one case, on the second day, the temperature in the rectum was only 99°. Wunderlich's special study of temperature in disease gives a peculiar value to the following results. He found fever, but of very unequal degrees, in all cases. The maxima of temperature were also various. In three cases, at the point of death, the temperature was 107°, 108° and 110°, respectively; in another case at the beginning 101.7°, and after several days 103°. In two rapidly fatal cases the temperature rose as death approached. In another fatal case the temperature, morning and evening, on two successive days, was 101.5° and 103°, 100° and 103.4°; and on the third day, 103°, 106.2°, 106° and 107.5°. Burdon-Sanderson found that in adults the temperature varied from 100° to 104°, and in children was still higher. Exacerbations of pain were always accompanied with an increase of the heat of the skin amounting to 2° or 3°. The extreme irregularity of the thermometrical results in this disease is regarded by Hirsch as one of its most distinctive characters. Ziemssen, quoted by

the last named author, states, as the result of his examinations, that "the temperature is so fluctuating that few of the curves representing it coincide." This irregularity in the results of thermometrical observations in epidemic meningitis adds another to the many features which distinguish that disease from typhoid fever and typhus. The maxima and minima in these several affections may not be materially different, but while in the two last named the temperature is progressive and is steadily maintained for several, or even for many days; in the former it is irregular and unsteady, now advancing, now subsiding, and all within a period of time much shorter than in the two fevers with which it is compared. And further, while in nearly every case of typhoid fever and of typhus the temperature is high, viz. above 103°, in one-third, at least, of the cases of epidemic meningitis it is below that degree.

Eruptions.—A personal study of the disease, as well as an examination of the recorded observations of others, makes two points very plain, viz: that in a large proportion of cases no eruption at all is present; and that eruptions of the most various characters may appear upon the skin. Following the plan hitherto pursued, we shall cite the records upon each of these two propositions.

Cases of Epidemic Meningitis without any Eruption.—North emphatically testifies that "eruptions are by no means a necessary attendant upon the disease;" and again, "they are by no means a constant or frequent symptom." Strong says, "these spots, which in 1806–7 marked almost every case, in 1808–9

were rarely observed." Fitch writes, "there are, however, some even among fatal cases without any such appearances (petechiæ and vibices) on the skin." Dr. Woodward says "an eruption on the skin so seldom appeared that it could no longer be considered a characteristic symptom of the disease." Haskell makes the statement that "neither the spots nor the eruptions are inseparably connected with the disease." All of these quotations are taken from the single volume of North on "Spotted Fever," and more might easily have been added. "In 1807, when the spotted fever first appeared at Hartford," writes Fish, "there were but few cases without petechiæ or livid spots: in the following years they were less common, and since then they have not been seen in that place, before death." Jackson and his colleagues declare that "they occur in comparatively few cases of the disease." Hale remarks very pointedly, "I have hitherto said nothing of any *spots* upon the skin, although their real or supposed appearance has in many places given a name to the disease. . . . I have never observed any tendency to the production of these spots, while the skin was moist, except in the fatal cases already mentioned." According to Gallup, "the eruption is not a constant attendant. . . . The proportion of cases which had distinct eruptions may be estimated at one-sixth;" and Miner informs us that "not more than two or three cases were, this season (1823), attended with petechiæ." Coming now to the Southwestern epidemic of 1846 and subsequent years, we find no mention of any eruption among the first cases which were reported by Boling; and in the

minute and accurate history furnished by Ames, it is stated that petechial spots existed in only one case. Hicks, Taylor and White appear to have observed them "in many of the more violent cases." Due allowance must here be made for the fact that many of the patients were negroes. If we study the history of the late epidemic, the evidence is to the same purpose. Kendall remarks, "probably a majority have no petechiæ at all; even some of a fatal character have not exhibited them." In Squires' very interesting narrative an eruption is mentioned in twenty-five out of forty-three cases. Upham found petechiæ "not an unfrequent manifestation." Black reports seven cases, in one only of which petechiæ are mentioned. Corson speaks of observing petechiæ "many times; Anderson, "in some cases;" Fassett, in only seven out of twenty, and Page, in eight out of sixteen cases; and in the Massachusetts returns we find that rather more than one-half, 59 per cent., presented some morbid appearance of the skin. Finally, during the recent epidemic observed at the Philadelphia Hospital, there was no eruption whatever in thirty-seven out of ninety-eight cases. An eruption of some sort was therefore present in 62 per cent. of these cases.

In European epidemics of meningitis the proportion of cases in which a general eruption existed was smaller still. In the Geneva epidemic of 1805, a considerable proportion of cases at the point of death presented purplish spots, some earlier than this, and some after death only. The same circumstance was observed in 1807, at Ashburton, England; in the Neapolitan epidemic of 1833, and in that which oc-

curred in Dublin in the present year (1867), ecchymoses were often present and in a very marked degree. In the Strasburg epidemic, on the other hand, only three cases of petechiæ were observed by Tourdes; at Rochefort and at Versailles, in 1839, they were "rarely" noticed; at Gibraltar, in 1844, they do not seem to have been observed; in 1848–9, at the *Val de Grace*, they do not appear to have attracted attention; at Petit-Bourg they were not noticed, although the state of the skin in other respects was fully described. In Prussia, in 1865, neither Burdon-Sanderson nor Wunderlich mentions petechiæ or vibices as occurring during life; Niemeyer saw petechiæ in one case only; Klebs found them in "several" rapidly fatal cases; and Hirsch, after mentioning their "occasional" presence, is obliged to draw upon American authors for an account of their aspect and time of appearance. Finally, among the ten cases reported by Dr. Law, of Dublin, in 1866, not one had a "petechial" eruption. Thus it is evident that, taking the whole of the cases of epidemic meningitis in Europe and in this country, the number of those in which petechiæ were present formed but a small proportion,—probably not one-tenth—of the whole.

Cases of Epidemic Meningitis with various Eruptions, not Petechial.—Strong speaks of efflorescences, carbuncles, pustules and buboes; North describes a "bright red" eruption; Woodward, "efflorescences of various sizes and shapes;" Haskell, &c. "a red fiery eruption, sometimes in clusters and sometimes in large and distinct pustules;" Bestor, "bright red spots," an "efflorescence resembling measles," and an "uniform

redness like erysipelas;" Fiske, "a miliary eruption," and sometimes "like the nettled-rash;" Fish, an "efflorescence resembling that of scarlatina;" Jackson, all of these different forms, and also large bullæ, as if produced by cantharides; and Gallup, Hale and Miner confirm these statements from their own observation. Ames observed "herpes labialis," so common in certain European epidemics, in several instances; Kendall, spots of "a scarlet or red rose color," as well as petechiæ; Squire, "cherry-colored spots," as well as petechiæ and ecchymoses; Jenks, "large elevated spots of the size of a twenty-five cent piece, of very dark color, presenting outside of the dark color a blistered appearance;" Reid, "an exanthematous eruption of short duration;" Poley, "peculiar small spots of a Spanish-brown color;" and Fassett, "an eruption which was petechial in four and erythematic in three" cases. The recent epidemic which we witnessed furnished examples of nearly every form of eruption met with in this disease. They have been correctly enumerated by Dr. Githens as "erythema, urticaria and petechial mottlings." He adds, "hemorrhagic ecchymoses, or vibices, were not present in any case. Of ninety-eight cases recorded, thirty-six had marked petechial eruptions, not disappearing under pressure; thirteen had mixed petechiæ and erythema; nine erythema and urticaria." Herpes labialis was noticed in a few cases. Tourdes was, we believe, the first who regarded the last mentioned exanthem as characteristic, at least by its frequency, of this disease, and other observers have noticed it; but it is certainly much less common as a symptom of epidemic menin-

gitis than either the roseolous or the petechial spots. This author, as well as a few others, occasionally met with the lenticular rose-colored spots so usual in typhoid fever; and the other exanthematous eruptions have occurred in a greater or less number of cases in nearly all European epidemics; but none of any kind, except herpes, occurred so frequently as to suggest to any one, except the Neapolitan, De Renzi, the idea of employing it to designate the disease.

In the Dublin epidemic of 1866–67, and for the first time in Ireland, a great variety of eruptions such as herpes, a general vesicular eruption, urticaria, bullæ, &c., was observed. Gordon described "a distinct *eruption*, which comes out with great rapidity, is found over all parts of the body, but chiefly on the lower extremities; is of a very dark color, sometimes very deep brown or purple, or even black; the spots are of various sizes and shapes, some small and round, others large and irregular; some appear like large spots of very black purpura, only more mottled and more irregular in color and shape; others are more confined and raised above the level of the skin, consisting in effusion into its substance." These appearances lead the author to remark that they do not "constitute or indicate any new type of disease;" but he did not suggest that they denote any affiliation with typhus. On the contrary, he resorted to the history of epidemic meningitis in this country and on the continent of Europe, to show that they especially belong to that disease. These various eruptions have been regarded by Law, Gordon and Hayden, as being

directly dependent upon the cerebro-spinal lesions which are characteristic of the disease. In support of this view, cases are cited in which traumatic and other lesions of the brain and spinal marrow, chorea, and powerful mental emotions have been accompanied or followed by eruptions upon the skin. In some cases *gangrene* of the skin has been noticed where the spots have been peculiarly dark, and occasionally, as in typhus, from prolonged pressure.

The *cause of death* in many of the more rapid cases is sometimes coma; but in some others, equally rapid, and attended with all the marks of dissolution of the blood, consciousness is but little impaired until the actual imminence of death. In many others, fatal in the midst of a well marked attack, death appears to depend upon asphyxia due to a pressure upon the medulla oblongata; in others, again, a slow and gradual asthenia exhausts the powers of life, sometimes leaving the mind clear until the approach of dissolution.

DURATION, CONVALESCENCE, SEQUELÆ, MORTALITY.

This affection, which in so many respects is singular, is altogether peculiar in the irregularity of its duration. In typhus the usual date of convalescence is between the thirteenth and sixteenth days, and that of death in fatal cases very nearly the same; in typhoid fever the attack exceeds three weeks, on an average, whether the patients recover or die. In contrast with this long duration, and this regularity of development, decline, and death, all observers of epidemic meningitis

agree that it runs its course with such unequal speed in successive cases that no general average of practical utility can be formed in regard to it. Strong says, "the disease appears in every shape, from the dreadful plague, which baffles all medical skill, and destroys life in five hours, down to the mild disease, which, if properly treated, will confine the patient only a few days." ... Of twenty patients, "seven died in less than twenty-four hours, five in less than forty-eight hours, three in less than seventy-two hours, and the remaining five from the third to the seventh day." North states that "unless the patient recovers, he commonly dies within the first twelve, twenty-four or forty-eight hours." If he recovers, the "attack runs into the form of a mild typhus of uncertain duration." In the epidemic described by Fish, "death took place, at different periods, between eighteen hours and seven days," and, he adds, "there have been instances of patients living ten or twelve days, and then sinking under the disease." Jackson, &c. besides confirming these statements, show "that even in cases where the attack has been very violent, and the powers of life overwhelmed at first, the patient has so far recovered as to be very comfortable in three or four days, suffering only a slight debility." Of such, we, also, have seen numerous examples. Gallup confirms all of these statements, and adds, "the common period of termination was somewhere between the fourth and the seventh day;" and this was precisely the average duration of Upham's cases at Newbern, North Carolina. Hale remarks: "in more than half the cases my visits were not extended beyond the first week." Ames

gives the extremes of duration as fifteen hours and fifty days; but by far the greater number terminated on the fourth day. This substantially was the result of Armstrong's observations in the recent epidemic at Mobile. Fassett, indeed, states that during the Vermont epidemic, "in no case did recovery take place in less than from three to five weeks;" but Ketchum describing the same epidemic says, "several lived five or six weeks from the date of the attack and then died" with brain symptoms, "while some lingered for three or four weeks with dilated pupil, deafness, opisthotonos, pain in the head, semi-delirium, and then died. In most of the patients that recovered the symptoms improved in forty-eight hours. . . . It is my experience that the duration of the disease is indefinite." Kempf says, "the duration of cerebro-spinal meningitis is from twenty-four hours to two or six days." The returns analyzed by Parks show that of ninety-five fatal cases, the duration was five days or under in sixty-six; eight days in one; and ten days or over in twenty-eight. In cases of recovery the duration was altogether indefinite, viz. from ten days to four or five months. Githens also shows the disease to be of uncertain duration. The acute attack rarely lasted through a fortnight; in a few cases the patients were declared convalescent in the first week. We have seen many slight but distinctly marked cases fully convalescent within the period last named. These references will perhaps suffice to impress upon the reader the peculiar uncertainty of the duration of epidemic meningitis. We might, were it not superfluous, illustrate the point more fully by citations from

European writers. Let it suffice to quote the expressive phrase of Tourdes, "the disease is distinguished by the slowness of its cure and the rapidity of its fatal issue;" and the conclusion of Hirsch that "its duration is between a few hours and several months."

Convalescence.—It will be inferred from the last paragraph that convalescence from epidemic meningitis is very irregular and uncertain. In this respect it bears a certain analogy to typhoid fever; for in both affections the long and unsteady progress of the return to health is owing to a local lesion, which may be present in every possible degree. Fish and Gallup among American, and Tourdes and Gillkrest among European authorities, dwell upon the rapid and extreme prostration and emaciation which attend the attack, and speak of a tardy and irregular convalescence as characteristic of the disease. In many cases it is, indeed, otherwise; and of numerous patients in the late epidemic, it may be said, as Hale remarked of his own, "in most instances the patients were out of their chambers within a week or ten days from the commencement of convalescence." Still, the general statement continues to be true, as it is expressed by Hirsch: "convalescence is irregular and protracted; in spite of good food and regular digestion, emaciation and debility are sometimes of long duration." Persistent headache, neuralgia, convulsions, stiffness of the neck or pain in moving it, morbid sensibility of some portions of the skin, palpitation of the heart, dyspepsia, &c., embarrass the return to health. "It is highly probable," as Gallup remarks, "that the in-

ternal membranous inflammation is always present more or less."

SEQUELÆ.—These, which are merely the phenomena of a retarded and imperfect convalescence, are deserving of notice. *Deafness*, or dullness of hearing, is a very frequent consequence of this disease, which has been observed by all European and native writers on the subject. In our recent epidemic it existed to a greater or less extent in sixteen cases. Very often the deafness is permanent. Out of twenty-four cases observed by Fassett, one half recovered; but three of them with entire loss of hearing, and one with partial deafness as well as strabismus. *Impaired vision* produced by opacity of the cornea, amaurosis, iritis, &c. are occasionally met with. *Paralysis* of one or more limbs, and general impairment of muscular power, are rare consequences of the disease; and loss of memory, and even insanity have sometimes been observed. Gordon thus describes the conclusion of a severe case: "the man has gradually passed into a state of almost organic life; he eats, drinks, and sleeps well; he passes solid fæces and urine without giving any notice, yet, evidently, not unconsciously . . . he seems to understand, but he cannot answer . . . he can draw up his legs and arms, but he cannot use his hands at all." *Relapses* are very far from being uncommon. Jackson, &c. state that they occur "in many instances;" Gallup speaks of them as "very common;" Hale notices "several cases;" and in numerous examples referred to by Parks, they were met with. It is remarkable that a large proportion of the last mentioned cases were fatal, while the earlier reporters

remark upon the usual termination in cure of second attacks.

Mortality.—Like all epidemic diseases, meningitis presents itself in every possible degree of gravity between a slight indisposition and a violent and deadly malady. Hirsch has published a table exhibiting the mortality of the greater number of epidemics of meningitis between 1838 and 1865, from which it appears that the death rate varied between 75 per cent. and 20 per cent. So, while the percentage of mortality was a little over 61 per cent. (170 deaths in 278 cases) during the recent epidemic in Massachusetts, it was but 33 per cent. (43 deaths in 130 cases) in the Philadelphia Hospital. It is to be observed, moreover, that while ten epidemics, in various places, occurring between 1838 and 1848 presented an average mortality of 70 per cent., a similar number occurring during the decade from 1855 to 1865 give an average mortality of about 30 per cent. This remarkable fact would seem to indicate a gradual decline of power in the epidemic cause.

FORMS.

We have several times, in the course of this history, referred to the multiplicity of forms assumed by the disease we are examining. To those who have not studied its records, nor had occasion to behold its multiform physiognomy, this peculiarity has been a source of innumerable errors and mistakes, the most serious of which consists in assimilating it to typhus,

and in applying to it a system of treatment, which, however it may be tolerated, or even necessary, in the former disease, is unequivocally mischievous in the latter. Forget classified the cases he observed at Strasburg as follows: A. CEREBRO-SPINAL: 1. *Explosive* (*foudroyante*); 2. *Comatose-convulsive;* 3. *Inflammatory;* 4. *Typhoid;* 5. *Neuralgic;* 6. *Hectic;* 7. *Paralytic* B. CEREBRAL: 1. *Cephalalgic;* 2. *Cephalagic-delirious;* 3. *Delirious;* 4. *Comatose.* In the first of these divisions three-sevenths belong to the first and fourth varieties; and in the second division five-sevenths to the first and second varieties, from which it may be inferred that coma in some degree, and pain in the head were predominant characters. But "there were slight and severe cases; violent and hectic forms; cerebral symptoms predominant in some, and spinal in others, and the functions of the nervous system were variously disturbed." Ames arranged his cases in two general divisions, viz: *The Congestive* and *The Inflammatory.* The Congestive he subdivided into the *Malignant* and the *Mild. Malignant congestive* cases were distinguished by prostation, coma or delirium, or both; opisthotonos; and a pulse of wide range. In *Mild congestive* cases a good degree of strength was preserved; the pulse was below 90; there were marked pain in the head and tenderness of the spine; and no coma, delirium or tension of any except the cervical muscles. The *Inflammatory* cases were, in general, distinguished by a temperature of the skin above that of health, and a full, firm pulse; but the *malignant* among them were marked by the early occurrence of delirium or coma,

great irregularity of the pulse, opisthotonos, convulsive spasm, strabismus and occasional amaurosis, with vomiting and a rapid and fatal course; the *grave* by a slighter development of the same symptoms, except coma and delirium; and the *mild* by a lower grade of febrile excitement, the preservation of a good degree of strength, a tendency to become chronic, and by the absence of coma, drowsiness, delirium, and a cold stage. Wunderlich classifies the cases according to their relative degrees of severity and the rapidity of development of the symptoms, and describes: 1, the *gravest* and most rapidly fatal cases; 2, the *less grave*, and 3, the *lightest cases*. The following classification is proposed by Hirsch: 1, the *abortive;* 2, the *explosive* (*m. siderans*, the same as *m. foudroyante* of Tourdes); 3, the *intermittent;* 4, the *typhoid*. Of the various forms admitted by different authors, and of which we have seen examples, we would class together A. The Abortive, in which the characteristic phenomena are often faintly defined, yet to the practised eye distinctive. B. The Malignant, in which the symptoms are exaggerated, the attack sudden, the course short, and the issue fatal. C. The Nervous, including *a.* the *ataxic*, viz: 1, the *delirious;* 2, the *cephalalgic;* 3, the *neuralgic;* 4, the *convulsive;* 5, the *paralytic;* and 6, the *adynamic*, viz: *a*, the *comatose*, and *b*, the *typhoid*. D. The Inflammatory. E. The Intermittent.

It would not comport with the purpose of this essay to describe in detail the several forms of epidemic meningitis. The greater number of them have been included in the analysis of symptoms already presented. But there are two which perhaps require a

few words of separate notice, viz. the Abortive and the Intermittent; the one because its real nature may be misunderstood, and the other on account of the peculiar circumstances under which it sometimes arises. Abortive meningitis is observed only during the prevalence of the disease in a more characteristic form. Thus, the mother of a boy who had died of the fully developed disease, "complained of the head and back and limbs, and of chilliness, and presented a petechial eruption. After active purgative and counter-irritant treatment, she was about work on the second day," (Sargent.) In Dublin, in 1846, Dr. McDowell remarked, that "when inflammation of the membranes of the spinal cord was frequent, and in many instances terminated fatally, it was observed that the symptoms of excitement of the spinal cord became developed in the progress of ordinary continued fever, without in any way tending to produce an unfavorable result." Gauné, in 1856, saw nineteen cases of the disease in the Children's Hospital, at Niort. All of them recovered. Dr. Burns, of Frankford, Philadelphia, while attending patients affected with the disease, was affected with headache, and severe pains along the spine and in every joint of the body, and a general languid feeling. Purgation and full doses of sulphate of quinia arrested the disorder in two or three days. Kempf, during the decline of an epidemic observed "a great number of individuals, especially adults, who complained of headache, malaise, neuralgic pains in various parts of the body, and pain in the nape of the neck or other parts of the spine." The case of a

young woman to which we referred upon a previous page was of the same nature.

The *intermittent* type has been described by Ames and other physicians in malarial districts, but it is by no means confined to such localities. According to Hirsch, the paroxysms are more or less regular, assuming the quotidian or the tertian type; the heat of skin, when this is present, the pains, cramps, delirium, &c. manifesting regular exacerbations and remissions, so that in fatal cases the attack resembles pernicious intermittent or remittent fever. Sometimes the intermissions are manifested during the prodromic stage, suggesting a delusive idea of the nature of the attack; sometimes the characteristic symptoms are intermittent; and sometimes this type first manifests itself during the decline of the disease, and naturally suggests the suspicion of a relapse. This occurrence is not to be confounded with a true relapse, of which some notice has already been taken.

ANATOMICAL CHARACTERS.

No other epidemic disease presents more definite and characteristic lesions, *post mortem*, than cerebro-spinal meningitis. According to its type and its duration there never fail to be found some of those changes in the membranes or in the substance of the great nervous centres which denote the existence of inflammation. Congestion of the blood-vessels and exudation of serum fibrin or pus beneath the meninges, and different degrees of alteration in the nervous pulp attest the nature of the process. And since

all or any of these may be found, it follows, that however essential the lesions may be to the idea of the disease, they do not constitute its exclusive manifestation. As death is compatible with the early and forming stage of the inflammatory process, as well as with its complete evolution, and as the former is not always sufficient to account for the fatal issue, it is clear, on this ground alone, that, as in other epidemic affections, there is a constitutional element, a morbid condition of the blood, which underlies all of the phenomena of the disease, and modifies, more or less, its physiognomy, just as the features of a man, which are material, assume the most varied expressions under the influence of the particular emotion or passion which at the time may be supreme.

Exterior.—In most cases *cadaveric rigidity* is well marked and long continued. Burdon-Sanderson states that this does not apply to the muscles which had been rigid during life. Strong, Jackson, Gallup and others have pointed out, and in the same terms, the discoloration of the dependent parts of the body which takes place after death; the purplish spots on the anterior surface, the redness of the eyes. &c. disappear or grow paler, while large patches of a livid color, or a uniform discoloration of the same hue may sometimes be observed along the posterior parts of the neck, back, nates and thighs. In a case of which we have published the details, the whole body became rapidly almost black during two hours before death; but afterwards the countenance nearly regained its natural hue. It was early noticed that the *muscles* everywhere exhibit a deeper shade of color than natural,

which is now said to be of a distinctive brownish red shade; but Gallup states that there is no evidence of a weakening of their texture. Klebs has, however, shown that the rapid and extreme emaciation observed in protracted cases of the disease is owing to atrophy of the muscular fibres, as well as of the interstitial connective tissue. The same observer has also detected by the microscope a granular deposit between the muscular fibres analogous to that which he found in typhoid fever and in acute poisoning by phosphorus.

The Scalp and Cerebral Vessels and Membranes.—In the very earliest account published in this country (1806) of the anatomical lesions of the disease, it is stated by Danielson and Mann that the veins of the brain were uncommonly turgid; Bartlett and Wilson repeat the statement (1810); and Stuart found the blood-vessels of the dura mater and brain distended. Jackson describes the flow of blood on separating the calvarium, and of serum on cutting the dura mater, (the latter liquid being of a reddish color,) and the great distension of the sinuses in cases of rapid death. In Ames' examinations the venous congestion was less, but the arterial vascularity greater. In some cases this extended to the dura mater, in others "the vessels lying across the convolutions were uniformly red, numerous and large." They were also found in great numbers on the walls of the lateral and other ventricles. In like manner, at the commencement of the recent epidemic, Squire said, "the large veins in their way to the several sinuses appear remarkably turgid;" and, during its continuance, the same report was

made by all who investigated the subject. So, in the European epidemics, from Vieusseux, who describes a "sanguineous engorgement of the brain," and Mathey, who speaks of the meningeal vessels as being "excessively injected," and from Tourdes, who states that the sinuses of the dura mater are filled with very dense coagula, and the vessels of the pia mater distended with blood, to Banks, who uses almost the same terms in his description, and Burdon-Sanderson, who found hyperæmia of the cranial diploe, distended blood-vessels of the dura mater whose internal surface was highly colored and minutely injected, and excessive congestion of the arachnoid covering the hemispheres,—the testimony is uniform, that congestion of the brain is an unfailing accompaniment of the first stage of the disease. Next, we find that the transparency of the arachnoid is impaired, as it is described, among others, by Lidell, Hutchinson, C. M. Clark, and as we have always found it when death did not take place in the congestive stage. Precisely the same condition is reported by European writers, who also, as well as our own observers, found the pia mater often adherent to the brain, and sometimes so closely that it could not be raised without lacerating the cerebral substance. This condition is particularly described by De Renzi, Tourdes, Gillkrest, Lionnet and others.

An effusion of serum is an ordinary condition *post mortem*. It is found in the arachnoid cavity and in the ventricles. In the former situation it was mentioned by Danielson and Mann. "As soon as the dura mater is cut through, a quantity of serous fluid

commonly escapes from under it. This is not always transparent like water, but sometimes quite red colored." Gamage says, "a serous fluid was contained between the tunica arachnoidea and the pia mater; the first membrane being raised from the latter in numerous cells." Ames found the effusion in many cases, and states that "pus globules were mixed with it in every case in which they were sought. In two cases the effusion consisted almost entirely of pus." Lidell reports a case in which at least six ounces of serum were discharged. In another case (Moorman), in which death took place on the thirty-fifth day, "on attempting to remove the brain, about three pints of turbid serum escaped." So, among European authorities, De Renzi refers to a case in which a pound and a half of serum was found between the dura mater and the pia mater. Tourdes says, "the arachnoid cavity ordinarily contained a small amount of serum; occasionally it was dry, or marked by flakes of pus."

The *ventricles* are also the seat of an effusion in many cases. The first record of the fact is, we believe, in Stuart's case, in which "the right lateral ventricle contained about a tablespoonful of serum;" Jackson says "the lateral ventricles always contain a notable quantity of water." Ames met with a purulent effusion in several cases; Craig, eight and twelve ounces of a limpid fluid in two cases; and Armstrong and Clark saw the ventricles distended with sero-pus. Serous effusion was observed by Mathey in these cavities; and Tourdes found pus in them in more than half of his cases, forming sometimes a milky fluid, sometimes the true yellow pus of phlegmonous inflammation.

Similar appearances are described by Gillkrest, Wilks, Burdon-Sanderson, Hirsch, Klebs and others. The last mentioned observer in one case found the lateral and the fourth ventricles and the aqueduct of Sylvius fully distended by thick yellow pus. It does not follow that every milky looking liquid contains pus corpuscles; in many cases the color is derived from exuded fibrin.

These anatomical conditions would serve to prove the essentially inflammatory nature of the process in which this disease involves the brain; but a more conclusive one remains to be described. This is *a fibrino-purulent exudation* in the meshes of the pia mater. Among early American physicians, the first who attempted to illustrate the nature of the new disease by dissection were Danielson and Mann, who, in their essay, which was published in 1806, give an account of two post-mortem examinations to which reference has already been made. Of the first they say, "the dura mater and pia mater, in several places, adhered together, and both to the substance of the brain;" and of the second, "between the dura and pia mater was effused a fluid resembling pus;" proving, therefore, that the lesions were those of meningitis. In 1810, Bartlett and Wilson reported a fatal case, in which, among other lesions, was found "an extravasation of lymph on the surface of the brain." In the same year the report of Jackson and his colleagues contained an account of the lesions, which leaves little to be added. After speaking of the congestion and serous effusion found within the cranium "in those who have perished within the space of twelve hours from the first invasion," they add, "the

other appearances we are to describe are more conspicuous in proportion to the duration of the disease. The tunica arachnoides and the pia mater are remarkably altered in appearance by the effusion of an opaque substance between them, which may be called coagulated lymph or semi-purulent lymph," . . . and then, speaking of the base of the brain, they remark, "an effusion of coagulated lymph in mass has been witnessed in the same part." Wilson, again, in 1813, described a case presenting "several small depositions of lymph on the surface of the brain." In 1818, Gamage found in one of his dissections, that "the tunica arachnoides seemed to be thickened, and two or three small portions of coagulable lymph were discovered upon its external face." After an interval of twenty years the same lesions were found in the epidemic at Montgomery, Alabama. Ames describes an abundant deposit of "lymph and pus" upon the exterior of the brain "under the arachnoid covering of the pia mater." At the base of the brain it was most abundant about the optic commissure, "indeed, at this place, either on the commissure and mamillary bodies, or between them and the tuber annulare, it was never absent." "It was also found on the corpora quadregimina, the medulla oblongata, and around the third pair of nerves. The inferior surface of the cerebellum was frequently the seat of this deposit." About the same time, in Massachusetts, Sargent found "under the cerebral arachnoid, over the upper surface of both hemispheres, a whitish deposit, as of purulent matter," and "on both sides of the cerebellum a considerable deposit of pus and lymph." In 1857, Squire stated that

in a case narrated by him, "beneath the arachnoid membrane was a plentiful effusion of yellowish white lymph," and at the base of the brain, "a perfect pool of sero-purulent fluid filled the foramen magnum." Craig found "lymph of a yellowish and greenish hue" upon the convexity and at the base of the brain.

We have called attention to the relation between the brain lesions and the duration of the attack before death. It was distinctly pointed out by Jackson and his cotemporaries; it is more elaborately presented by Upham, in his history of the epidemic at Newbern. When death took place within two or three days there was commonly opalescence of the membranes, flocculi of lymph in the subarachnoid fluid of the convexity of the brain, and an exudation of thick yellow lymph at the base. After a longer period the exudation was more pus like, or more abundant and concrete. In two cases, of which the one lasted for twenty-four hours and the other for twenty-three days, Jewett found that these conditions were well contrasted, serum predominating in the one and dense lymph in the other. Ketchum, also, refers to the stage of the disease causing the lesions to vary between congestion and exudation; and Githens notices the influence of this element in determining differences in the appearance of the exudation even in a class of cases all of which might be termed inflammatory. In point of fact there were scarcely any others in the epidemic of which he has sketched the history. Similar grades of the specific lesion are recognized by European writers, as we shall presently show.

It might be inferred from the silence of Vieusseux

on the subject, that in the Geneva epidemic of 1805 there were no brain lesions of a distinctly inflammatory sort, just as it has been too hastily alleged that the American epidemic of the same period was an idiopathic fever, for no better reasons than that dissections were not made at all by the first historian of the disease, and in some other cases of rapidly fatal course vascular engorgement of the encephalon only was detected. But we have seen that abundant evidence of meningeal inflammation in the American epidemic existed, and the same is true of the cotemporaneous prevalence of the disease at Geneva; for Mathey thus describes the lesions in one case: "the meningeal blood-vessels were strongly injected. A jelly-like exudation tinged with blood covered the surface of the brain. . . . On the lower surface of the brain and in the ventricles a yellowish, puriform matter was found." A full and particular description of this lesion is furnished by Tourdes. Sometimes the exudation was liquid, and sometimes concrete, like butter spread over the surface of the brain. Sometimes it was scanty and disposed in streaks along the veins; sometimes it was more abundant and formed rounded islands of various extent; generally it remained superficial, but sometimes, also, penetrated between the convolutions. Its consistence varied extremely; now, it was like thin pus, and again had the aspect and firmness of a false membrane. "It existed about equally on the upper and lower surfaces of the brain fourteen times; on the upper alone eight times, and chiefly six times; at the base alone twice, and chiefly nine times; in the ventricles twenty-six

times; on the optic nerves nine times; on the pons varolii four times; on the medulla oblongata three times; on the olfactory nerves twice, and on the cerebellum in nearly every case." Lesions almost identical with those just described were found by Gillkrest at Gibraltar; Ferrus and others at Petit-Bourg; Wilks, in London; Gordon and Banks, in Dublin; Gaskoin, in Portugal; and Niemeyer, Hirsch, Burdon-Sanderson and others, in Germany. In some cases, as in that of Banks, the exudation is confined to the base of the brain, while the blood-vessels of the convexity of the organ are highly congested. The solid, semi-solid, or more fluid material constituting the exudation is found, on microscopical examination, to consist of cell-like bodies imbedded in a transparent interstitial substance, or corpuscles and granules floating freely. Burdon-Sanderson remarks, that "the cell-like bodies, although in general resembling pus corpuscles, did not present that uniformity of size and character which is met with in normal pus. . . . The interstitial substance was beset with granules, some of which were albuminous, others fatty." Upon this point Klebs remarks that very often pus exists where it is not visible to the naked eye, and where even with the aid of the microscope it is necessary, in order to recognize it, that the observer should be familiar with its transition forms. Some of these he describes as analogous to mucous corpuscles.

The most recent researches have fully confirmed the judgment of Jackson, Upham and other American writers, that the physical qualities of the exudation depend partly upon the original type of the disease,

and partly upon its duration. In malignant cases death occurs before time has sufficed for the full development of inflammatory lesions; in those of longer course may be found, first of all, turbid serum, then a more or less pasty and fibrinous deposit with some admixture of pus, and, finally, in cases of long duration the exudation becomes tougher, more adherent, and shrivelled.

The *substance of the brain* is generally softened. We have met with but one reporter (Hale), who describes it as being firmer than natural. Danielson and Mann state that "the substance of the brain was remarkably soft, offering scarcely any resistance to the finger when thrust into it, and the cerebellum was found in the same state;" and Bartlett and Wilson say there was "a looseness of texture or disorganization through the whole substance of the brain." Ames found softening in nine out of eleven cases, "in some part of the hemispheres, chiefly the cortical, in seven cases; in the medulla oblongata and pons varolii, in three; in the fornix and septum lucidum, in five; in the walls of the third ventricle and canal leading to the fourth, and in the infundibulum, in one case," &c. It was observed by Craig in several cases, and in one of them after an illness of several months duration; in another, which terminated fatally on the thirty-fifth day, Moorman found the brain softened in circumscribed patches; C. M. Clark describes this alteration of a high grade in several cases; and Russell, with many others, repeats the same testimony. As a summary of these lesions and their relation to the period of death, the following description by Chauffard is instructive. "When death had taken

place rapidly the upper portions of the brain were gorged with blood, the arachnoid already cloudy and as if thickened, and a layer of pus upon the corpora quadregimina, the optic chiasm, the pons varolii, and the anterior portions of the base of the brain; the ventricles contained serum, and there was local and more or less extensive softening of the spinal cord. When death occurred in the second week, there were wide strips of false membrane beneath the arachnoid, and pus in the ventricles, the walls of which were softened; pus abounded at the base of the brain and of the cerebellum and in the spinal canal; and the spinal marrow itself was softened and sometimes reduced to a mere pulp. When the period of death was still later, or very long delayed, the interior surface of the ventricles, the fornix and septum lucidum were reduced to a pultaceous and creamy consistence, and in the latter case escaped into the adjoining cavities. Portions of the spinal marrow were completely destroyed, and in their place was found only a yellowish liquid, or the empty membranes fell into contact when it was wanting." It is unnecessary to quote in greater detail the statements of European writers upon this subject, since they do but reproduce the observations of our own physicians. They, however, make use of arguments to show that softening of the brain in epidemic meningitis is a true anatomical lesion and not a cadaveric phenomenon; that in fact it arises from a local and persistent œdematous infiltration, or from the presence of minute sanguineous extravasations.

Spinal Marrow.—The earlier writers whom we

have quoted in the preceding pages do not afford much information respecting the anatomical conditions of this nervous centre. It was not until the time of the publication of Tourdes' Essay that it was habitually examined, or that the importance of its lesions was appreciated. It may be stated, in general terms, that the lesions of the spinal marrow and its membranes are identical with those of the encephalon. The dura mater is often very dark; its blood-vessels are engorged; the cavity of the arachnoid is distended, and upon incision gives issue to serum, which may be clear, or mixed with blood, or simply turbid, while in advanced cases a profuse discharge of pus may take place from the puncture. C. M. Clark mentions a case in which two ounces of pus were collected in this manner. The spinal pia mater presents analogous varieties in the proportion and distribution of the exudation to those found in the brain. They have been described, among other native writers, by Ames, Sargent, Squire, Upham, Woodward, Lidell, Armstrong, Craig, Moorman, Russell and Clark, and among foreign authors, by Tourdes, Lionnet, Wilks, Banks, Burdon-Sanderson, Wagner, Niemeyer and Hirsch. The more concrete, and even the purulent exudation is not always, nor even usually, diffused equally over the cord; often it is limited to the anterior, and more frequently to the posterior face or to some particular region or regions of the organ, the larger collections, in the latter case, being connected by streaks of lymph or pus. These accumulations are usually most abundant at the lower end of the cord, and may be found around the roots of the nerves.

Their excess in the lower and posterior portions of the cord is attributed by Klebs to the influence of gravity. *Softening* of the spinal marrow appears to be less frequent than that of the brain. But Ames relates a case in which the cervical portion was softened, "the filamentous portion interiorly being reduced to a disorganized pulp." In a case referred to by Hirsch, the central canal of the cord was distended with pure pus. More complete destruction sometimes occurs, as above described by Klebs and Chauffard. Partial and superficial softening of the cervical portion we have seen repeatedly.

The Blood.—Next to the great nervous centres, the blood presents the most important changes in this disease; they are, however, as diverse as the lesions affecting the meninges of the brain and spinal marrow. But we should here distinguish between blood drawn from a vein during life and blood found in the body after death, and in both cases between the adynamic or malignant and the sthenic or inflammatory types of the disease. Pursuing, at first, the chronological order, we find it stated by Arnell, in 1811, that "the blood drawn in the early stage appeared like that of a person in full health; there was no unusual buffy coat, neither was the crassamentum broken down or destroyed." Fish, also, speaking of the same epidemic (1809), says: "two patients were bled: one furiously delirious, the other comatose; in neither of these did the blood present any uncommon appearance. There was no inflammatory buff, nor was it dissolved. In one case, in 1807, where the eyes were suffused, it had a slight buffy appearance;

in another, in the following year, it was darker, and had a larger proportion of serum than usual. The two last-mentioned cases proved fatal in a few hours after the patients were bled." Andral noted a very marked increase in the fibrin of the blood "in a case of cerebro-spinal meningitis, in which, after death, he found the spinal marrow surrounded, in its whole extent, by a sort of purulent sheath, the pus having infiltrated the pia mater." "At the autopsy," says Tourdes, "the blood was remarkable for the abundance and toughness of the fibrinous clots." Faure-Villar also notes the buffy coat as characteristic of the blood. In 1864, Dr. Ketchum found that "the blood had every appearance of blood taken from a patient laboring under acute inflammation." Ames states that "the blood taken from the arm, and, by cups, from the back of the neck," "coagulated with great rapidity." "Its color was generally bright—in a few cases nearly approaching to that of arterial blood; it was seldom buffed: in thirty-seven cases in which its appearance was noted it was buffed in only four." Analyses were made in four cases, "the blood being taken early in the disease from the arm, and was the first bleeding in each case. The first was from a laboring man, thirty-five years old; the second from a boy twelve years old, while comatose; and the two others from stout women between thirty and thirty-five." I. Fibrin, 6.40; corpuscles, 140.29. II. Fibrin, 5.20; corpuscles, 112.79. III. Fibrin, 3.64; corpuscles, 123.45. IV. Fibrin, 4.56; corpuscles, 129.50. Tourdes states that "blood drawn from a vein was rarely buffed; if a buffy coat existed, it was thin, and

generally a mere iridisation upon the surface of the clot." Analysis furnished the following results: I. Fibrin, 4.60; corpuscles, 134. II. Fibrin, 3.90; corpuscles, 155.54. III. Fibrin, 3.70; corpuscles, 143. IV. Fibrin, 5.63; corpuscles, 137.84. Maillot gives, as the eresult of analysis in six cases, an increase of fibrin to six parts, and more, in a thousand. Thus, in not a single case in which the blood was analyzed did it contain less than three parts of fibrin in one thousand, less, that is, than the proportion of this element in healthy blood. On the contrary, it perfectly represented the condition of the blood in inflammatory diseases. These are, we believe, the only reports which have been published of a qualitative analysis of the blood in epidemic meningitis, and it has been objected to them that they were made of blood taken "at a second or third venesection, when the proportion of fibrin would naturally be increased" (Draper), and that "the proportion of fibrin may rapidly increase even during venesection" (Klebs). As to the latter objection, it appears futile, for it would apply to the standard analyses of the blood in other diseases; and as to the former, it is not founded in fact, for in most of the cases the blood was derived from a first venesection. Besides, it would not apply to the proportion of the corpuscles, which it is well known diminishes rapidly as blood is lost, whereas in the present instance it shows a decided increase.

In regard to the condition of the blood after death, it has already been stated that Tourdes and others found firm fibrinous clots in the heart and large vessels: but perhaps the greater number of observers

have reported it to be dark and liquid. Such it was stated to be in the report of Jackson, and also by Lidell, Gerhard, Levick, Niemeyer, Gordon and others, and such we found to be in the greater number of cases which we examined at the Philadelphia Hospital. But in two instances, at least, the heart contained large and very firm fibrinous coagula. Several observers have noted a shrivelled or crenated appearance of the edges of the blood disks, and an irregular distribution of these bodies in the field of the microscope instead of the ordinary arrangement in *rouleaux* or piles.

It is evident, therefore, that when venesection has been practised, the blood has uniformly presented the characters indicative of inflammation, and that in some epidemics, especially in France, a similar condition has been observed even after death; but that in a large number, probably in a majority of fatal cases, the blood, after death, has been found dark, and either liquid or else containing only soft clots. It follows that the conditions which occasion death in a large number of cases include a disorganization of the blood. But it is equally true that in many others death results from causes independent of such a change, and, as we shall see hereafter, from a direct interference with the functions of the nervous centres which are necessary to life. It is probable that post-mortem fluidity of the blood exists under two conditions; the one when the epidemic or zymotic cause is so intense from the commencement of its action as to destroy very rapidly the vitality of that fluid; the other when the powers

of life are very gradually exhausted by the indirect operation of the same influence. In the latter case the inflammatory elements of the disease are more or less gradually overcome by the prolonged action of the peculiar morbid poison which is essential to the generation of the disease.

It is unnecessary to dwell upon the condition of the lungs, heart, stomach, intestines, liver, kidneys and spleen, in fatal cases of epidemic meningitis. These organs present a variety of lesions, depending upon the patient's previous health, and upon the complications which may arise during the fatal attack, but none whatever which properly belong to the pathological history of the disease. When the *joints* have been swollen and painful during life, pus has been found in them by Levy, Klebs, Ottman and others. The lesions which have been met with in cases of *deafness* do not always suffice to explain this symptom. It might be supposed that the existence of so large a deposit of lymph upon the root of the seventh nerve, as is generally found, would be habitually attended with more or less impairment of hearing. But such is not the case; and where the symptom exists, it must probably be ascribed to an alteration of structure in the brain or medulla oblongata, or to what has in some instances been demonstrated (Klebs), suppuration of the internal ear.

CAUSES.

It may be said, in general terms, that epidemic meningitis has occurred in all portions of the tem-

perate zone inhabited by European races and their descendants; in all sorts of localities, among all ranks and conditions of society, at all ages, and in both sexes, and that it is therefore in the strongest sense of the word a pandemic disease. And when the statement is added that the disease is not disseminated by contagion, it evidently falls into the category of the diseases referred to, of whose occurrence no other explanation is at present possible than that they are directly produced by a specific atmospheric poison. Yet there are some peculiarities in the circumstances which have attended many of its outbreaks, which, if they do not bring the case under the laws which are known to regulate the occurrence of other epidemics, may at least serve as materials for an induction which shall hereafter lead to the law under which this disease, also, is generated. The very first particular which, in the natural order of causes, we must inquire into, illustrates this statement.

Season.—In the United States epidemics of meningitis have taken place with great uniformity in the winter and spring, as we learn from North, Danielson, Mann, Fitch, Woodward, Fish, Warren, Gallup and Hale, respecting the early occurrences of the disease; from Ames, respecting the epidemic of 1848–9, and from Squire, Parks, Upham, Ketchum, Armstrong and many others, respecting the last epidemic. Indeed we are acquainted with but one exception to the rule: the epidemics at Middletown, Connecticut, are stated by Miner to have prevailed between the last of March and the last of December, 1823, and in the summer of 1825. We should have regarded

the rule as equally absolute for Europe; but it appears to be less so, although the proportion of epidemics in summer is comparatively small. In Germany the rule has been nearly the same as in the United States; but in France, out of 216 local epidemics, 166 occurred between December 1 and May 30, while in the other six months of the year there were 50. So in Sweden, out of 417 local epidemics, 311 took place in the former period and 106 in the latter.

Weather.—It is evident from the above statement that cold and heat have neither of them an absolute influence in the causation of this disease, although its development is clearly favored by cold. The mode of action of this agent may, perhaps, be considered hereafter.

Localities, of every sort, high and low, dry and moist, those saturated with marsh miasmata, and those favored by the pure breezes of mountain districts have been alike invaded by epidemic meningitis; it has passed by large cities reeking with all the corruptions of a soil saturated with ordure, and a populace grimed with filth, to devastate clean and airy villages, and the families of substantial farmers inhabiting isolated spots.

Sex, Age and Occupation.—Instead of destroying females and old and infirm people, its victims are chosen, in far greater numbers, from among persons in the very bloom of youth and early manhood than from any other class. It has in many places been noticed that the proportion of males attacked is much greater than of females, and such is probably the general rule. Thus, in Massachusetts, where the

female population is greatly in excess, there was a preponderance of nearly sixty per cent. of male over female patients. In France this difference was all the more striking, because the first epidemics of meningitis were so exclusively among males, and especially among young *military recruits* in garrison, that its cause was sought in some peculiarity of the soldier's life, or in some supposed unhealthy condition of the military barracks. Yet there are other places, as Sweden, and certain towns in Germany, where the proportion of deaths among females equalled or even exceeded that among males: and in Leipsic, the garrison remained entirely exempt while the disease prevailed among the citizens. In this country there were instances which suggested that the conditions of military life are peculiarly favorable to the development of the disease. Such was the fatal epidemic in 1847 in the second regiment of Mississippi Rifles, which originated in and was confined to that body, during and after great hardships and exposure to inclement weather (Love). During the late civil war, while there was at least one military post, Newbern, North Carolina, at which the disease raged violently, and while it occurred among the soldiers at Gallop's Island, in Boston harbor, it never became epidemic in the army, although nearly every possible predisposing cause of disease existed within its limits, and although this very disease prevailed at the time among the civil population. Without going further into particulars, it may perhaps be sufficient to state that everything proves conclusively the inadequacy of the causes which have been considered to deter-

mine the development of epidemic meningitis, independently of the concurrence of an unknown specific cause.

Debility.—It has been a favorite theory that whatever causes weaken the system predispose to and even excite this disease. Thus we find the following passage in North's treatise. "The exciting causes are better understood. They are such as immediately debilitate the system, as too much fatigue, fear, grief, nursing, abuse of stimuli, wetness, cold, and other diseases preceding, as the measles and influenza, and chincough. Among these, as far as I have observed, *cold is the most frequent exciting cause.*" The same statement is repeated, substantially, by Fish and by Jackson, who subjoins that it is not made "in conformity with general principles," but is "founded on the observations of correspondents." Some have attributed the recent epidemic to the depressing influence of *war*, forgetting that the disease prevailed for several years before war was even so much as apprehended. A vast array of facts exists to demonstrate the virulence of the disease in places crowded with a *poor and filthy population;* but these facts possess no special value. They merely illustrate the general and familiar proposition that all diseases, and especially all epidemic diseases, occasion a greater mortality among the hungry, filthy, and vicious, and among the feeble and fearful inmates of public establishments for the poor, than among the independent, industrious, and relatively virtuous classes of society. Alongside of such instances, moreover, are hundreds of others, like the rural districts and large towns of

our own country, and like the garrisons in France, where the victims of the epidemic were remarkable for their excellent physical condition and their freedom from mental anxiety. What was true of the first epidemic, in Geneva, has everywhere been found true. "The disease," says Vieusseux, "attacked people of all ranks at once, poor and rich, in every district of the city, in narrow, dirty and crowded rooms, and in great houses where clean and well aired chambers had but a single occupant." Chauffard, speaking of the epidemic at Avignon, in 1840, says: "it selected for its attacks only men of from twenty to thirty years old, fresh and vigorous young men, wholly exempt from morbid proclivity, and who died, almost all of them, in full flesh." The morbid agencies which have been referred to are permanent in all large cities; and, if they were really efficient, they should always determine the occurrence of the disease, but they notoriously do not. There are three cities, at least, in which all of these causes have attained an intensity of virulence unparalleled elsewhere; and yet neither in London, Liverpool nor New York has meningitis become epidemic. The soil is, indeed, there in which all morbid germs whatever which are adapted to the climate must flourish; but the specific germs of this disease have not yet been sown in it under conditions appropriate for their development. In other words, while we know that a certain material poison will generate typhus, and a certain other typhoid fever, we are not acquainted with the conditions which are essential to the production of epidemic meningitis. We may know that some

external influences appear to favor, but we know of none that are essential to, its generation.

CONTAGION.—The contagiousness or non-contagiousness of epidemic diseases is a question which has always given rise to differences of opinion, and sometimes to acrimonious disputes, as the history of yellow fever, typhoid fever, cholera, &c. abundantly exhibits. If, therefore, a new disease arises, and those who have observed it independently of one another agree in representing it to be communicable, or non-communicable, by the sick to the well, their judgment may be regarded as conclusive. In the present instance it may be affirmed that epidemic meningitis has been pronounced non-contagious by almost the unanimous verdict of competent judges. The few dissentients only prove the rule. Let us, as heretofore, examine the witnesses in chronological order.

Among American writers who described what they saw, the following may be referred to. North declares categorically, "it is not a contagious disease," and again he repeats that such is the opinion of "all those physicians who have witnessed its ravages." So Haskell, Spooner and Holmes declare, "we cannot discover a single instance in which it clearly appears that the disease has been communicated from one to another by contagion;" and Fiske writes as follows: "this I can affirm, that in all the cases of the spotted fever which I have seen, not one could fairly be traced to this source." Fish, while asserting that "there are facts which go to prove that it is infectious" (contagious), admits that "it is not more infectious (contagious) than the common typhus (typhoid fever)

or autumnal fevers of our country," which last statement is an admission that it is not contagious at all. And this is the conclusion which the committee of the Massachusetts Medical Society tell us, "it is very generally agreed" to adopt. Hale furnishes negative as well as positive evidence of its non-transmission from the sick to the well. Coming down to the recent epidemic, we find that among the cases that occurred in Stanton Hospital, "no relation by contact could be traced" (Lidell). In Vermont, Ketchum was led by experience "to conclude that the disease was not contagious;" and Holbrook reached the same conclusion. In Massachusetts, "out of 268 cases" in which the question was answered in reference to their origin through contagion, "the answers were negative as to 252." In the epidemic which we observed in the Philadelphia Hospital, no evidence whatever of contagion was afforded. Not a few historians of the disease omit, in their reports, all notice of this question, as if it was one that had not been suggested by their experience. Neither Ames nor Upham nor Squire refers to it.

In Europe, the first authentic history, by Vieusseux, says "the disease did not extend in the neighborhood of the sick;" and again, the disease appears to depend "upon peculiar atmospheric conditions, and not on a contagion communicated from man to man;" and, once more, the author proposes to call the disease "malignant *non-contagious* cerebral fever."* In

* In an excellent paper upon this disease, (New York Medical Times, September, 1864, p. 113,) Vieusseux is credited with saying, "we do not doubt that this was a malignant *contagious* fever." This

the epidemic of Strasburg, "a study of the facts resulted adversely to the idea of its spread by contagion" (Tourdes); the same conclusion was reached by Ferrus, at Petit-Bourg; Wunderlich found "not the slightest indication of contagiousness" in the disease at Leipsic; nor Burdon-Sanderson, in Dantzic; nor Mannkopf, in Berlin. Indeed, the only writer of authority who has contended for the contagiousness of epidemic meningitis is Boudin, who refers to cases in which the disease affected certain garrisons without extending to the surrounding civil population, or the soldiers of certain barracks while it spared the prisoners confined separately within their limits, or *vice versa;* and other cases in which it seems to have accompanied a regiment to new and healthy quarters, and then attacked the recruits there incorporated into the affected regiment, or the civilians in communication with its members; and again others in which certain barracks were occupied by different regiments in succession, and in like order were attacked; and finally, cases in which the disease spread to physicians, nurses, and other attendants upon the sick. The last statement is in direct opposition to universal experience; and the preceding ones, supposing them to be accurately reported, only show the existence of some local cause capable of determining the development of the disease in all who came within its influence; a cause susceptible of being transported by healthy men, or

mis-statement is probably due to Boudin, of whose exceptional notions we may have occasion to speak. Mathey, observing the same epidemic with Vieusseux, says, "the idea of contagion, which had alarmed many persons, had to be abandoned."

by their camp equipage, from one place where the disease existed to another where it had not previously occurred. The views of Boudin have failed to satisfy and convince all judges who have examined them. They fail most where most they need strength, in the proof that the disease is ever communicated from man to man; and, without that proof, there is no evidence of contagion. If there is one point in its history which is established by the concurrent testimony of American and European writers, it is the extreme rarity of its attacking the physicians and the nurses in attendance upon the sick, and those patients affected with other diseases, who occupy the adjoining beds in hospital wards.

PROGNOSIS.

It will have been observed in the paragraph refering to the mortality of this disease that, its issue, in general, is extremely uncertain, since the death rate varies between widely remote extremes. It was there mentioned that the general percentage of mortality caused by epidemic meningitis had, on the whole, been annually declining since the beginning of its last appearance. Yet while writing this statement we learn that the mortality at the Hardwicke Hospital, Dublin, in 1866, was not less that eighty per cent. In like manner, when it is affirmed that the disease occasions a less *mortality* in the *spring* than in the winter, the proposition should be accepted in reference only to the epidemics which having begun in midwinter decline in the spring months, and not

to those which commence at the latter season. It has frequently been observed that the severest cases occur in persons previously in good health. The disease certainly exhibits no peculiar tendency to attack the delicate and feeble. In the late epidemic at the Philadelphia Hospital, nearly all of the patients were "of a vigorous and hardy appearance," and those whom we saw at the St. Joseph's Hospital and in private practice were most severely attacked in proportion as they were of the same condition. The *age* of the patients is also an important element in prognosis. The mortality is greater in childhood than during adult life, and after the age of thirty or thirty-five it increases rapidly. The disease is nearly always rapid in its development; but suddenness of attack or a very short premonitory stage is generally an unfavorable sign. This is especially the case when the early symptoms are comatose. But of whatever nature, violence in these symptoms portends immediate danger. Thus Niemeyer states that life is most endangered during the first four days of the attack. Out of thirty-eight deaths, twenty-three took place within that period. The conclusions drawn by Parks from his careful analysis, are, "first, the prognosis, during the first few days, at least, is grave; secondly, after four or five days have elapsed, if fatal symptoms be not present, the prospect becomes more hopeful; thirdly, the patient is not safe, even in convalescence, since there have been instances of fatal relapse." It is remarked by Mannkopff, what, indeed, is true of many, if not of most other diseases, that a prognosis cannot safely be grounded upon individual symptoms,

since the attack may pursue a course diametrically opposed to theirs. It is this author's opinion that, on the whole, the cerebral are of graver importance than the spinal phenomena. In this he is opposed to Tourdes, who says that prominent spinal phenomena are of grave significance, while cerebral without spinal symptoms are favorable. Everything, we should judge from our own experience, would depend upon the quality of the cerebral disturbance. The greater number of rapidly fatal cases present but few and ill-defined spinal symptoms. That delirium, even when violent, is less dangerous than persistent and deep coma cannot be doubted. The latter is, however, by no means constant even in fatal cases; nay, not even in such as terminate fatally within a few hours. Its absence therefore is not unequivocally favorable. A symptom of much more evil augury is a want of perception of the gravity of the situation, or unconcern about its issue. A preternaturally slow pulse is dangerous, especially if it be compressible, giving a delusive sensation of fullness and force. Among the most unfavorable nervous symptoms are "lively jactitation, rigid retraction of the head, spasms of other than the spinal muscles, general convulsions, extensive hyperæsthesia, dilatation and insensibility of the pupil, retention or incontinence of urine, and all cerebral paralyses" (Mannkopf), to which may be added deep coma, paralysis of the muscles of deglutition, and a rapid change of the pupil from a dilated to a contracted condition. Coolness of the surface is very significant of danger, especially when the skin grows purplish by the diffusion of blood beneath it, or even

by venous stasis. An eruption of petechiæ has everywhere been regarded unfavorably, but less so than the condition just named, while the other numerous and light colored eruptions incident to the disease are rather favorable than otherwise. The more rapidly the dark discoloration or eruption is developed the more significant it is of peril. Profuse sweats during a soporose state; bullæ and gangrenous spots; bronchial obstruction with serum or mucus; pneumonia and pericarditis,—these are all signs of danger. The unfavorable signs drawn from the digestive organs are chiefly these: a dry, fissured, or shrivelled and pale tongue (Fish), a fuliginous condition of the mouth; swelling of the parotids (of minor importance); obstinate vomiting; profuse diarrhœa, especially at an advanced stage of the disease, and persistent albuminuria. On the other hand, the general mildness of the symptoms, a slight loss of strength, a moderate degree of pain and muscular stiffness, the absence of petechiæ or vibices, (although in many grave epidemics they are of rare occurrence); a desire for food and the ability to digest it,—these, it need scarcely be said, are favorable indications. It will be found imprudent too confidently to predict the issue of any grave case of the disease. Patients have recovered when all hope seemed forbidden, and others have died on the sudden accession of nervous symptoms, cerebral or spinal, when the hour of danger seemed to have passed away. In other cases, again, death has come to the patient's relief after months of helpless misery.

DIAGNOSIS.

The diagnosis of epidemic meningitis may be either direct or differential. The former includes the characteristic symptoms of the disease. These have been already pointed out, but it is proper in this place to recall them. They depend partly upon a special abnormal blood crasis, and partly upon inflammation of the cerebro-spinal meninges. The various proportions in which these elements are commingled determine the physiognomy of the disease in individual cases. Although not absolutely characteristic, and therefore not decisive in an individual case, yet suddenness of attack and rapidity of development, when they have occurred in many cases, suffice to determine the character of an epidemic of the disease. The most distinctive phenomena are these: acute pain in the head, neck, spine and limbs, faintness, vomiting, stiffness or spasm of the cervical or spinal muscles, hyperæsthesia of the skin, delirium alternating with intelligence, and merging afterwards into dullness, or coma; occasionally convulsive spasms; paralysis of the face or of one side of the body. The evidences of blood poisoning are, the epidemic prevalence of the disease, various eruptions upon the skin (herpes, roseola, petechiæ, &c.), ecchymoses, debility out of proportion to the evidences of local disease, redness of the eyes, foulness of the tongue and mouth, and more or less of the other conditions which characterize the typhoid state. To these features must be added the rate of mortality, which is greater in most epidemics of meningitis than that of any disease with which it is liable

to be confounded. Some writers draw a distinction between epidemic and *sporadic meningitis;* but if by the latter term is intended an idiopathic disease, we are obliged to confess our ignorance of its characteristics. Meningitis may occur as an effect of traumatic causes, and of sunstroke, which is, in fact, a traumatic cause, and may be excited by tubercle and other morbid deposits in the brain or its membranes, and by various other mechanical irritants; but of its occurrence as a primary idiopathic disease no conclusive evidence exists. We have never met with an example of it; neither has Hirsch, who, while admitting that some such cases have been (erroneously) reported, states as a proposition, which no one, we imagine, can gainsay, that the whole of medical literature does not contain a single case of *sporadic* idiopathic cerebro-spinal meningitis with the characteristic *sudden onset* of the epidemic disease. Niemeyer asserts that cases of sporadic meningitis are almost without exception symptomatic of some primary disease or injury; and Klebs, that they are extremely rare. Köhler's exhaustive treatise on *Meningitis Spinalis* presents an array of spinal complications in various diseases which must amaze the ordinary observer; for he exhibits them in dentition, sunstroke, rheumatism, suppression of habitual discharges, and suppression and metastasis of eruptions, in scrofula, tuberculosis, syphilis, gout, cholera, yellow, intermittent and typhoid fevers, in uræmia, cholæmia, hydrophobia, and poisonings of various kinds,—yet it does not seem to have entered his mind that epidemic meningitis could be regarded as a complication or epiphenomenon of any other disease; on the

contrary, he declares expressly that he had no personal knowledge whatever of that affection. It is but just, however, to say that he admits the occasional occurrence of sporadic idiopathic cerebro-spinal meningitis, and he cites one case out of three or four which he himself met with. This case is given in detail, and, except in the absence of an eruption, is characteristically well defined. But it occurred at Halle, in 1857, while a severe epidemic of the disease was prevailing in Sweden. Gordon speaks of the possibility of confounding epidemic meningitis with *hysteria*. He refers to a few cases which advanced treacherously, with slight malaise and vomiting, lassitude, and occasional pain in the back and limbs, rendered very acute by pressure. These symptoms, occurring in delicate females, were occasionally regarded and treated as hysterical. Such an error seems hardly excusable. The symptoms enumerated would rather suggest neuralgia or rheumatism than hysteria. Fassett states that he saw many cases of nervous disorder mistaken for the epidemic disease: "the community were greatly excited and alarmed, and every catarrhal or ephemeral fever was magnified by their fears into something terrible. Every hysterical girl was at once set to cramping, with her head bent backwards, if from any cause she had an attack of headache; nor were these actions limited to girls, but many nervous ones of the sterner sex had similar *fearful* attacks."

Typhoid fever has only that degree of resemblance to epidemic meningitis which is common to all diseases of which the typhoid state is an incident. The con-

trast was noted by more than one of the earlier American historians. It is to be remarked that the term *typhus* employed by them always indicated what is now called *typhoid fever;* for they were acquainted with no other form of continued fever. The same is true of most German authors, even at the present time. Many French writers fail to make the distinction, also; and English treatises until recently, confounded typhus, typhoid, and relapsing fever and epidemic meningitis under the common designation *Fever*. In New England, where, as in France, the endemic fever is typhoid fever, the last error was not generally committed. Hale says, "it has been customary to give the name of typhus to all fevers in which prostration and exhaustion are prominent symptoms, however variable their character in other respects. . . . But if typhus is to be considered as a peculiar disease, the fever under consideration was not a typhus; for it did not exhibit the characteristic symptoms which belong to that disease. It had not the regular approach, nor the uniformity of appearance of typhus. Its progress was more rapid, its features more variable, its changes more abrupt, and its termination more sudden." No better summary of the symptomatic distinctions between typhoid fever and epidemic meningitis has been offered, so far as relates to the general course of the two diseases. Fish pointed out the distinctive characters of the two diseases in these terms: "in typhus we have an increase of arterial action, a foul tongue, bitter taste in the mouth, and loss of appetite, clearly indicating a disordered stomach. The intestines also

are deranged; the excretions are altered in quality or quantity; the temperature is increased, and the skin hot and dry; in short, between almost every symptom of the two diseases, when they are carefully compared, there will be found a material difference."

The impression made on Vieusseux by the epidemic of Geneva is expressed in these words: "its symptoms differed from those of every form of fever with which the physicians of Geneva were acquainted." And let it be remarked, that in that epidemic all the elements of the disease were present in full force; the signs of blood changes and those of cerebro-spinal inflammation were equally distinct. Tourdes refers to the slow approach of typhoid fever and the rapid onset of epidemic meningitis; the exquisite pain in the head, the neuralgic pains, spinal and other, the opisthotonos, convulsions, alternate delirium or coma and clearness of mind in meningitis contrasting with the hebetude, stupor, or muttering delirium, and the complete muscular relaxation in typhoid fever. The sordes on the tongue, the diarrhœa, the meteorism, the intestinal hemorrhage of the latter, instead of the moist or simply dry tongue and the transient vomiting and torpid bowels of the former; high fever on the one hand, slight on the other; diffluence of the blood and increase in the proportion of fibrin; suppuration within the cranium and lesions of the intestinal follicles; these as well as the extremely different duration of the two affections and the circumstances under which they occur, draw a line of distinction so broad that none but the blind can fail to see it. Such seems, also, to be Niemeyer's opinion, when he says

that the contrast is so clearly defined that it is unnecessary to present parallel pictures of the symptoms and course of the two diseases.

Typhus fever.—Before contrasting typhus fever with epidemic meningitis, it is necessary to say a word respecting the term "spotted fever," which was the ordinary designation of the latter disease in the infancy of American medical literature. In this history we have constantly made use of the documents relating to epidemics of "spotted fever," as if they had been more appropriately entitled, and no one familiar with the subject will call in question the correctness of the method. We have elsewhere shown that the epidemic which prevailed in this country from 1806 to 1815, and was described by Strong, North, Hale and others, was in reality a meningitis; and Parks has demonstrated the same truth by a detailed tabular comparison of the symptoms and lesions in that epidemic and the present one. It may also be mentioned that Dr. J. L. Chandler, of St. Albans, Vermont, who witnessed the first epidemic of meningitis in that neighborhood, and the recent occurrence of the disease in New England, recognizes the two affections as identical. (*Boston Med. and Surg. Journal*, lxx, 287.) We should have thought it of less consequence to rectify the error to which we now refer, had it not been committed by so eminent a physician as Hirsch, who, in his Monograph on *Epidemic Meningitis*, states that "spotted fever" "has nothing in common with epidemic meningitis," and refers to a chapter in his great work on Epidemics for the proof. In that place is to be found a faithful description of

the symptoms of the disease, by Miner, Strong, Fish and Kirtland, from which it is inferred by the author that the affection was so peculiar that none analogous to it could be found in the whole range of epidemiological literature. "Unfortunately," he remarks, "the reporters have not furnished an account of a single post-mortem examination, so that we are reduced to conjectures in forming a judgment concerning its nature." It is very much to be regretted that the distinguished author of this opinion had not been acquainted with the dissections made from 1806 onward, by Danielson and Mann, Bartlett and Wilson, Jackson and others, which we have described elsewhere, and which demonstrate conclusively that the "spotted fever" of that period was an epidemic meningitis.*

Considering, now, more particularly, the diagnosis between typhus and epidemic meningitis, it may be remarked, that by most of the historians of the latter disease the distinction is insisted upon in strong terms, while others, as Hirsch, do not even notice it. Several, however, maintain the identity of the two diseases, as will be pointed out hereafter. Among American writers upon the subject who recognized the latter as a separate and distinct affection, the following may be cited. "The malignant fever," says North, meaning typhus, "is dissimilar to this disease in the following respects: the petechiæ do not generally appear in so early a stage of that fever as in this; that fever makes a more regular course in its progress, like other

* Corson, in his report on the epidemic witnessed by him, says: "the disease, as described by Dr. North, though no reference is made to its pathology, was clearly a cerebro-spinal meningitis."

fevers, than this; death does not happen so suddenly in that fever as in this; death happens in that fever in seven, fourteen or twenty days; in this, it commonly happens within forty-eight hours from the attack; that fever is said to be contagious; this is not." Miner says, "we occasionally see the typhus petechialis of nosologists, but it differs essentially from the spotted fever of New England;" and again, "in common language, this epidemic has been generally called typhus, though it varies essentially from all the fevers which have received that appellation by foreign authors." And once more: "this epidemic, very obviously was not common typhus, as that term is intended to include the nervous and putrid fevers of the older authors." Fenner at first mistook the disease for typhus, but in a short time he became convinced that it was cerebro-spinal meningitis. Dr. Gerhard was the first person in Philadelphia to call attention to the present epidemic. If any one was competent to distinguish another disease from typhus, it certainly was he who first established upon a firm foundation the diagnosis of the latter disease from typhoid fever. It is true that in some points his conclusions were erroneous; but he pointed out the rapid and irregular course of cerebro-spinal meningitis, the absence of calor mordax and the odor peculiar to typhus; the great difference in the mortality of the two affections; and the contagiousness of the one, and the absence of that quality in the other. In Lidell's excellent paper, it is said of the two affections, "both of them are blood diseases, and both of them are apt to be associated with cutaneous ecchymoses. But

here the resemblance ends. If we examine their clinical history with a critical eye, we find that they differ from each other as widely as typhoid fever and measles." He then alludes to the chief points of difference. Epidemic meningitis often runs its course in a few hours; typhus requires at least several days. In the one disease convulsive movements occur, in the other not; in one the eruption frequently appears upon the first day, in the other not until the end of a week or more: "the two diseases are not identical, but entirely distinct from each other." So J. S. Jewell concludes from a tabular analysis of the phenomena of the two diseases, that "they are not identical, but really present wide differences;" cerebro-spinal meningitis is "a disease *sui generis*, and not a mere form of typhus as it has been assumed to be." Woodward, also, points out, in detail, the differences between the two affections.

Tourdes, referring to the spinal symptoms said by some writers to be present in typhus, remarks that epidemic meningitis has more than once been confounded with that disease, and he explains the error by a reference to the extremely varied physiognomy of the former affection. Levy arrives at the same conclusion. Lebert objects to those who confound the disease with typhus, that it differs from that affection in its anatomical characters, its particular symptoms and its general course, and its mortality. Niemeyer declares that he is utterly unable to comprehend how certain authors should have mistaken epidemic meningitis for a form of typhus, or have even

supposed it to be a nearly allied affection. It may be objected, perhaps, that the continental physicians who expressed these opinions were not familiar with typhus fever, and were, therefore, incompetent judges of the disputed question. Without attaching much importance to this objection, we are quite content to rest the decision of the question upon the evidence of those who were familiar with both diseases, as, for instance, the physicians of Ireland. It is true that they at first (1849) confounded the new affection with other diseases comprised under the vicious denomination, "*fever*," while they agreed that they never before had met with a similar "fever," and they soon learned to term it cerebro-spinal arachnitis or meningitis. Quite recently (1867), Stokes found that it differed from typhus in the rapidity of its course, in the character, mode of appearance, and duration of the eruption, and in its cerebro-spinal symptoms. Gordon has, also, stated his opinion that the marks which distinguish the two diseases have been so well laid down by certain American authors that it is difficult to confound them. He adds, "Murchison, I conceive, has utterly failed in his attempt to connect them." In England, also, the conclusions of this gentleman have not been accepted, and the *British Medical Journal* maintains that "it is impossible even to place the two diseases next each other in the nosology, much less to admit their identity. . . . So complete is the contrast between them, that it is scarcely possible to mention a single characteristic of the former which is also possessed by the

latter." Hirsch goes farther still, and, after comparing epidemic meningitis with various diseases, including typhus and typhoid fever, in which the typhoid state exists, remarks: "the analogies which bind typhoid affections together in a single group are extremely loose, and hence it becomes all the more difficult to include epidemic meningitis within it, particularly when it is remembered, that apart from its very obscure pathological essence, there is hardly anything in its symptoms or lesions which bring it within that comprehensive and elastic title *typhus*." For our own part, having, as already stated, had ample opportunities of studying both diseases, and especially having witnessed in a large hospital, and during two successive winters, an epidemic of each disease, we fully adopt the language just quoted as faithfully representing what we conceive to be the truth. It is very true that without an accurate analysis of the symptoms, the diagnosis may sometimes be attended with difficulty; but equally true it is that the nosological table is filled with examples of superficial resemblances between diseases which are radically different. It is not long since the two great fevers, so unlike one another in their causes, phenomena and lesions, were regarded as merely casual varieties of the same disease. Indeed, epidemic meningitis itself, was, as we shall presently see, comprehended, with still other affections, in the same nosological group, which, with a sublime contempt for the teachings of early English and continental physicians, was labelled with the vague and inexpressive term *Fever*.

TABULAR SUMMARY.

EPIDEMIC MENINGITIS.	TYPHUS FEVER.
A *pandemic* disease. Occurs in places remote from one another, and without intercommunication.	Essentially an *endemic* disease. Always due to local causes. Spreads by intercommunication only.
Attacks all classes of society. Is never primarily developed by squalor and deficient ventilation.	Attacks primarily the poor, filthy, and crowded, alone.
Is not contagious.	Contagious in a high degree.
More males than females attacked.	The two sexes equally affected.
More young persons than adults.	More adults than young persons.
Generally occurs in winter.	Epidemics are irrespective of season.
Eruptions are wanting in at least half of the cases; they occur within the first day or two.	The eruption is rarely absent, and appears between the fourth and the seventh day.
The eruptions are very various, including erythema, roseola, urticaria, herpes, &c. Ecchymoses are common.	The eruption is uniformly roseolous and then petechial. Ecchymoses are rare.
Headache acute, agonizing, tensive.	Headache dull and heavy.
Delirium often absent; often hysterical, sometimes vivacious, sometimes maniacal. Generally begins on the first or second day.	Rarely absent; usually muttering. Rarely begins before the end of the first week.
Pulse very often not above the natural standard; often preternaturally frequent or infrequent. Is subject to sudden and great variations.	A slow pulse exceedingly rare. Its rate is pretty constantly between 90 and 120.
"The temperature is lower than that recorded in any other typhoid or inflammatory disease." It is also very fluctuating.	The temperature is always more or less elevated, and it does not fall until the close of the disease. "The skin is hot, burning, and pungent to the feel."
The body has no peculiar smell.	The mouse-like odor of typhus is characteristic.
The tongue is generally moist and soft; sordes of the teeth, &c. is rare.	The tongue is generally dry, hard, and brown; and the teeth and gums fuliginous.
Vomiting, generally of bilious matter, is an almost constant and urgent symptom, especially in the first stage.	Vomiting is rare, and not urgent.
Pains in the spine and limbs of a sharp and lancinating character are usual, and evidently neuralgic.	Pains are dull, heavy, and apparently muscular.
Tetanic spasms in a very large proportion of cases and within the first two or three days. They are due to an inflammatory exudation within the spinal canal.	Tetanic spasms are unknown in typhus. Convulsions sometimes occur, due to "pyæmia."

EPIDEMIC MENINGITIS.	TYPHUS FEVER.
Cutaneous hyperæsthesia is a prominent symptom.	The sensibility of the skin is generally blunted.
Strabismus common.	Rare.
The eye, if injected, has a light red or pinkish color.	The blood in the conjunctival vessels has a dark hue.
The pupils are often unequal.	Always equal.
Deafness often complete and permanent.	Hardly ever permanent, or attended with signs of disorganization of the ear.
Duration very indefinite; but generally from four to seven days.	Duration from twelve to fourteen days.
Relapses are common.	Relapses are rare.
The blood is often highly fibrinous.	The blood is never fibrinous.
The lesions, unless in the most rapid cases, consist of a fibrinous or purulent exudation in the meshes of the cerebro-spinal pia mater.	There are no inflammatory lesions whatever.
Mortality from 20 to 75 per cent.	Mortality from 8 to 40 per cent.

Finally, and to sum up the elements of this contrast, we cannot do better than to quote the following passage from Dr. Murchison's admirable treatise, in which he sets forth the diagnosis of typhus fever from "Meningitis." "At the commencement of this century, the symptoms of typhus were referred to cerebral inflammation; and at the present day, typhus is not uncommonly designated 'Brain Fever.' The chief points of distinction between typhus and inflammation of the brain are the following: in inflammation, the headache is much more intense, and of a throbbing, darting, bursting, or constricting character; in typhus, the patient rarely describes it by such terms. The delirium of inflammation is more violent and acute than that of typhus, and accompanies or alternates with the headache; whereas the headache has almost always ceased in typhus before the delirium commences; the loud cries and screams observed in the

delirium of meningitis do not occur in typhus. In inflammation there is great intolerance of light and sound; but in typhus the senses are obtuse, and deafness is more common. In both diseases the face is flushed, and the conjunctivæ are injected; but in typhus the flush is more dusky, and the blood in the conjunctival vessels of a darker tint than in inflammation. In both diseases there may be general convulsions, followed by coma, but typhus never commences in this way, as meningitis sometimes does. Strabismus and partial palsy are far more common in inflammation than in typhus. The physiognomy of meningitis is anxious and expressive of pain, or wild and defiant; in typhus it is oftener blank and stupid. In typhus there is much more muscular prostration from the first than in inflammation. The pulse in inflammation is usually firm; in typhus it is soft and compressible. Nausea and urgent vomiting are common in inflammation; rare, in typhus. Lastly, in typhus, there is a peculiar eruption appearing about the fourth or fifth day."

In this description the following points, alone, are inapplicable to epidemic meningitis, so far as relates to its cerebral phenomena. In that disease there is not usually "intolerance of light or sound," nor "less muscular prostration from the first" than in typhus; nor is the pulse "usually firm," because there is associated with the inflammatory element another one which is, in different cases, "asthenic" or "adynamic." But the reader will probably admit that in every other respect the description tallies accurately with the picture we have composed from so many portraits

of the disease by different hands. Yet its author had not at all in view epidemic meningitis, which he had never seen, but either the tubercular, the traumatic, or some other secondary form of meningitis; for as a primary idiopathic disease, meningitis, whether cerebro or spinal, has not, as we have already stated, been proved to exist. Now, it is very singular that, after having furnished so definite and detailed a diagnosis between meningitis and typhus, and after having shown, moreover, by the testimony of Reid, Peacock, Jenner, Jacquot, Baraillier and Mœring, that the lesions of typhus are quite independent of inflammatory action, Dr. Murchison should, when at last he encountered a few cases of the former disease, have regarded them as examples of typhus fever with cerebro-spinal symptoms. Such an error can perhaps be explained by supposing that these particular cases were examples of typhus complicated with epidemic meningitis such as have more recently occurred in Dublin, or that they were simply examples of epidemic meningitis, of which numerous cases occurred in London in 1865, '66 and '67. But it is evident that Dr. Murchison did not thoroughly appreciate the characteristic conditions and phenomena of the two diseases. For example; when he asserts, as he has done, that epidemics of meningitis "occur under precisely the same circumstances as those in which typhus appears," he is in opposition to universal experience. As we have shown elsewhere, crowding, filth, hunger, &c. may possibly favor the development of this disease, as they will that of any epidemic whatever. But these causes *generate* typhus *de novo*, which is a very differ-

ent thing. Again: the author says, "like typhus it has been propagated by contagion," a statement in direct conflict with the testimony of every one who has witnessed an epidemic of the disease, except Boudin, whose opinions upon this and other matters concerning meningitis have been repudiated by all instructed judges. The spastic muscular rigidity of epidemic meningitis broadly distinguishes that disease from typhus; and Dr. Murchison, in his history of the latter disease does not even suggest the possibility of such a complication. If, then, as he now informs us, "during the last three years" he has "in several instances noted strabismus, tetanic contractions of the muscles of the limbs, and even opisthotonos," is it not probable that they were in reality cases of the epidemic meningitis which then existed in London, or of typhus complicated with the latter disease? Dr. Murchison also finds that "many American physicians admit the close relation of cerebro-spinal meningitis to typhus, while some maintain the identity of the two diseases." We believe, on the contrary, that among American physicians who have had an opportunity of studying the two diseases, not one has confounded them. The error has been committed by several who did not enjoy this advantage. Dr. Murchison also adopts the judgment of Dr. Upham, that the disease "partakes of the nature of typhus" with "a special direction to the meninges of the brain and spinal cord." Now, is it the typhous condition to which the meningeal inflammation is superadded, or is the meningitis the primary affection? Is it an inflammatory typhous affection, or a typhoid inflamma-

tion? To this question but one answer seems admissible. An inflammatory typhus fever would assuredly be a new thing under the sun; but a typhoid inflammation is one of the most familiar types of disease. A typhus fever with a special direction to the cerebro-spinal meninges, appears to us a very pathological monstrosity. The meningeal inflammation is evidently due to quite another element than that which originates the typhous symptoms. The one is specific, peculiar, and characteristic of this disease alone: the others are incidental, non-essential, and common to this disease and many other diseases. That which distinguishes epidemic meningitis is the concentration of the morbid action of the disease upon the membranes of the nervous centres, and the tendency of that morbid action to purulent or plastic exudation. If those who die of it in the first stage do not always exhibit inflammatory exudation, it is simply because death arrests the inchoate process in its earliest steps. If the patient survive for several days and then perishes, the characteristic lesions are revealed. But it is not so in typhus. No stage, grade, or usual complication of that disease was ever attended by cerebro-spinal exudation. In the one, exudative matter is detected by the microscope first, and then, in due course, by the naked eye; in the other, such matter is discoverable at no stage and by no method whatever of examination. "When the rash of typhus is present," says Murchison, "it may always be concluded that there is no cerebral inflammation." But there are writers upon "typhus" who describe inflammatory products beneath the cerebral membranes. Thus,

Roupell states that "in all the cases an affection of the membranes of the brain was found, either turgescence of vessels, increased vascularity, effusion of serum or pus, or the deposition of lymph, varying from the thickness of a line to a quantity only sufficient to render the arachnoid opaque." And Southwood Smith says, the arachnoid "is seldom or never in a healthy condition. It is always either more vascular than natural, or when in this respect unchanged, it is altered in structure, being thick, opaque, and milky; when in this latter state a gelatinous fluid is usually effused beneath it." This author also furnished a series of cases in which such lesions were discovered. Now either Dr. Murchison and all other writers who have described typhus fever since its diagnosis was established, have fallen into a gross error in denying the presence of any such lesions in that disease, or the authors from whom we have quoted, and others who might be cited to the same effect, erred in their diagnosis, and mistook epidemic meningitis for typhus fever, or, it is possible, observed cases in which the two diseases were associated. Of the correctness of the latter alternative there is every probability, as well upon the general grounds already stated, as upon this, that Smith's Treatise was published in 1829, and in the preceding and following years we know that the disease existed in this country, and at Sunderland, in England; and that Roupell wrote in 1839, when it is certain that epidemic meningitis prevailed in France, and may have also existed in London sporadically. For these reasons, which may be summarily stated as follows: 1. That the

causes, symptoms, course, termination and lesions are radically unlike in the two affections; and 2. That all physicians who have witnessed epidemics of both affections, agree in pronouncing them to be different; we conclude that typhus fever and epidemic meningitis are distinct diseases, having, indeed, nothing in common but the typhoid state.

NATURE.

The preceding considerations, it is believed, will be thought sufficient to demonstrate that epidemic meningitis is not typhus fever, and it therefore only remains to show what is its real nature. Upon this question we have already several times expressed our opinion, which is sustained by the judgment of nearly all who have thoroughly investigated the subject. Before offering the proof of this statement, it may be amusing, if not profitable, to cite the theory of one of the earliest, if not one of the most instructive, among early American writers upon this disease, Dr. Job Wilson. This ingenious author discovered that "spotted fever" is an "influenza!" These are his words: "the similarity of the influenza to spotted fever is so striking, that had it not been for the accidental appearance of spots in some cases, the probability is, that the present epidemic would still have continued to be called by that name." This author presents a tabular abridgment of the symptoms common to the two diseases, and concludes that they correspond in all the most important particulars, and that he "can discern no utility in considering and treating the

spotted fever and influenza as distinct diseases!" In comparison with this the error of confounding typhus fever and epidemic meningitis is trivial, indeed, and venial. It is remarkable that the only point of real analogy between the two affections should have escaped an author so possessed by his peculiar and original idea. Both diseases are, in the strictest sense, pandemic. Produced by no local agencies whatever and by no ascertained conditions of the atmosphere; arising spontaneously and simultaneously at remote points, and being incommunicable by the sick to the well, it is impossible to refer them to any other than specific atmospheric causes. But here the analogy ceases; the characteristic phenomena of the two diseases are as different as smallpox and diphtheria. It may, perhaps, be truly asserted not only that these two affections are, in a true sense pandemic, but that they are the only ones possessing that character. All other epidemics are propagated more or less, and either directly or indirectly by contagion, however much atmospheric conditions may favor their diffusion. But epidemic meningitis and influenza appear to proceed, primarily and alone, from some unknown constituents or conditions of the atmosphere, or some conjunction of terrestrial causes, the nature of which at present eludes our comprehension altogether, and about which it is an idle waste of words to speculate.

But to return. We shall show that while, as the reader has already seen, some few physicians have confounded epidemic meningitis with typhus, ignoring altogether its essential and characteristic local

lesions, and while a small number also regard the disease as an inflammation merely, the great majority of those whose sagacity enabled them to perceive, and whose experience entitled them to judge, agree perfectly in assigning to it a compound nature derived on the one hand from its specific cause, and on the other from its local lesions, and proving it to be at once a blood disease and a meningeal inflammation. Dr. Strong's inferences from the symptoms of the disease show that he divined its morbid anatomy: "it is evident," he remarks, "from the symptoms, that the principal seat of the disease is in the brain and nerves. This, we think, appears from the delirium and coma, which almost always attend; from the dilatation and contraction of the pupils; the dimness and loss of sight; the deprivation of taste; the frequent nausea and puking, while the contents of the stomach do not appear to be morbidly affected; from the severe pains in the head; from the numbness which creeps over the surface, and the torpid insensibility which pervades the whole system. It is likewise evident that debility and great prostration of vital energy are the enemies with which we have to contend." Jackson and his colleagues, in their report, arrive at this conclusion: "the disease is fever combined with internal inflammation." Fish says, "spotted fever is seated in the brain and nerves." Gallup concludes that it is "an ataxic fever with a special tendency to inflammation of the membranes of the brain." Drake is of the opinion that it is not a mere fever symptomatic of inflammation of the brain; that "there is a lesion of innervation made, we know not where, which is

followed by another of circulation, giving us simultaneously both fever and inflammation." Davis says, "I regard the disease as an asthenic inflammation of the cerebro-spinal nervous centres with their investing membrane, accompanied by a highly septic condition of the blood." According to Moorman, the disease "is essentially an inflammation of the posterior and basilar portion of the brain and spinal cord, and their meninges." These judgments at different periods since the first advent of the disease in this country, it will be seen, substantially agree. European testimony upon this subject is to the same effect, but is generally given in a more detailed and precise form. Like American authorities, foreign writers give prominence to the septic or to the inflammatory element in their definitions according to the peculiar type of the epidemic which they have had to study. Tourdes remarks, "although pathological anatomy demonstrates an inflammatory element in the disease, it is certain that there is something besides; it is a specific inflammation, a poisoning, a cerebral typhus, produced by a specific miasm which has an elective affinity for the membranes of the nervous centres." C. Broussais adopts the less comprehensive view, and recognizes but one element in the disease. He says: "it is an ordinary but violent inflammation which differs from other acute and fatal phlegmasiæ, only in its seat." In like manner Levy remarks, "its most constant and striking characteristic is the tendency to suppuration . . . and it is not a typhus, whatever analogies with that disease it may present."

The physicians of Dublin during the recent epi-

demic agreed that it was a very different disease from typhus, while some laid more stress upon its inflammatory and others upon its septic element. Among others, Dr. Law, who had had peculiarly favorable opportunities for observation, "looked upon it, no matter how modified, as cerebro-spinal arachnitis;" Dr. Kennedy held it to be both a blood disease and an inflammation, the latter being less essential than the former; Dr. Hayden recognized the same elements in the disease, but maintained, on the contrary, that the cerebro-spinal inflammation is at least as original and primary as the disorder of the blood; Dr. Moore "thought physiology and pathology must lead us to view this disease as essentially of a cerebro-spinal character;" Dr. Banks "believed the disease was a blood disease, and that the greater number of cases were cerebro-spinal arachnitis." The same opinions, substantially, were expressed by Dr. Stokes. It is, says Wunderlich, "a disease, *sui generis*, and is not to be regarded merely as the expression and representative of internal local lesions." The symptoms, he further remarks, are not in exact proportion to the lesions, nor are they all explicable by them. Hence it is necessary to admit a constitutional as well as a local element of the disease, which often, indeed, becomes the predominant one, just as in eruptive and typhoid fevers, in diphtheria, dysentery, erysipelas, &c. the most fatal cases are those precisely in which death occurs at so early a stage, through the violence of the constitutional element, that the local lesion remains incomplete or is entirely undeveloped. Hence, too, in the disease under consideration, its physiog-

nomy varies with the predominance of the blood changes on the one hand, or of the meningeal lesions upon the other; and there is every probability that in this, as in most other epidemic diseases, the morbid cause exerts its primary action upon the blood. Hirsch concludes that the disease is *sui generis*, different from all others etiologically and pathologically. It has no local origin nor geographical limits, is due to no local causes, nor any appreciable conditions whatever, and therefore it can only be due to a specific cause. It differs from many other epidemic diseases by the concentration of its poison upon a single organ, while many phenomena distinctly indicate its operation throughout the whole economy, especially the petechial and other eruptions, but most of all those rapid cases which terminate fatally within a few hours. This is also, substantially, the judgment of Niemeyer and Mannkopf. Klebs illustrates his opinion by suggesting the analogy of epidemic meningitis and of typhoid pneumonia, in which also, there is a predominant typhoid type and a local inflammation. The same may be said of epidemic dysentery. Klebs remarks further, that it may be questioned whether the general disorder of the system proceeds from the local affection, or whether both are not direct effects of the unknown epidemic cause. Having ascertained that even when inflammatory lesions are invisible to the naked eye, they may nevertheless be detected by the microscope, he concludes that these lesions are essential to the disease and are direct and primary effects of the action of the morbid cause. Apart from this we should still so regard them, inas-

much as they are uniformly, and even visibly, present if death has not intervened to prevent their development. So constant a lesion cannot be accidental, and must be essential. The inflammatory element and the septic element are both necessary to constitute the disease; either may be in excess and overshadow the other. According to the relative predominance of one or the other, the disease assumes more of a typhoid or more of an inflammatory type, and it is this diversity in its physiognomy which has led to such opposite doctrines in regard to its nature and its nosological affinities.

NAME OF THE DISEASE.

Gallup commences the chapter "On Spotted Fever," in his work on Epidemics, with these words: "Having little anxiety what name is attached to any particular habit of disease, provided that the name does not influence the treatment, we shall not dispute about this, and shall be as willing to continue it as any other; and more so at this time, as everybody knows what is meant by it." Here are two bad reasons, at least, for an erroneous conclusion. Words are things; and few indeed are the physicians independent enough to treat a disease by one method, when its accepted name clearly indicates the decision of the profession that an opposite method is alone appropriate. If everybody knew what is meant by "spotted fever," many papers, including Dr. Gallup's and the present one, might have remained unwritten, and the learned physicians of Dublin, in college assembled, would not

have proposed at least eight different names for the existing epidemic.* It is well known that the disease is popularly called "spotted fever," and that a great many physicians have, perhaps thoughtlessly, adopted the popular name. It is not so well known, or recollected, that the epithet *petechial* was early used by physicians in this country, although the term was really less accurate than the vulgar one, inasmuch as purpurous spots were more frequent than petechiæ. North himself, in 1809, designated the disease as "typhus petechialis, or the malignant spotted fever." But in 1811, he writes, "this symptom (petechiæ) does not occur so often as the name which this disease has obtained would lead one to expect." Perhaps, also, he discovered that the name had been already appropriated to quite another affection by Huxham and Hoffmann, and many others after them, viz. petechial typhus with which Irish emigration, and some local epidemics, have made the physicians of our Atlantic seaports familiar. Strong had the same experience as North, and guided by it made a similar statement. "So frequent, indeed," he remarks, "was this species of hemorrhage (petechial) during the first season in which the disease prevailed, that it was considered one of its most striking characteristics, and gave rise to the name PETECHIAL, or SPOTTED FEVER, which has been very generally though

* The following are the names referred to. "Malignant purpuric fever" (Stokes); "Cerebro-spinal fever," and "Fever with cerebro-spinal meningitis" (Gordon); "Febris nigra" (Lyons); "Malignant purpura" (McSwinney); "Pestilential purpura" (Banks); "*Black death*" (A. Smith); and "Cerebro-spinal meningitis" (Hughes, Law, Banks, Hayden, Moore, Bennett, and others).

very improperly applied to the disease." In 1808, W. Foot wrote, "some have given it (but improperly) the name of *spotted fever*." In 1810, the committee of the Massachusetts Medical Society remarked that "the name of spotted or petechial fever has been considered improper by most medical men who have had occasion to remark upon the subject." In 1812, a writer in the New England Journal, referring to the same subject, remarks: the disease "being only occasionally accompanied with spots, it seems somewhat out of rule to name it by a character which is so little constant." In the following year, and in the same journal, another writer calls attention to the rare occurrence of petechiæ, and remarks that "the employment of this appearance to designate the disease, must, therefore, be considered very unfortunate." In the same journal, also, of 1814, we find that "well informed practitioners of all descriptions are dissatisfied with the name;" and again: "the discontinuance of the name 'spotted fever' is not merely desirable for the sake of correctness of speech, spots being neither *peculiar* to, nor *constant* in this complaint; but where this name prevails, the frequent absence of spots leads to doubts as to the existence of the disease." So Fish, in 1815, remarked, "the name by which the disease is known is incorrect; because, strictly speaking, it is not a fever, and it is rarely attended with petechiæ or spots." In 1822, Miner expressed himself strongly upon the subject, in these words: "it is quite unfortunate that a single symptom (petechiæ), and one, too, which is wanting in a great majority of the cases, should have been seized

upon, to give *the odious and deceptive name of spotted fever*, as that name has been applied by European writers to a very different kind of fever. Indeed, petechiæ may appear in diseases of a very different character; and often in purpura hemorrhagica, sea-scurvy, and other chronic complaints which are unattended with fever." Finally, in 1849, when Sargent published an account of cerebro-spinal meningitis, as it occurred in Millbury, Massachusetts, he referred to the history of the epidemic of 1812, and to the name it received in these words: "they gave the name (spotted fever) to the epidemic only because its lesion was not known, and the name was picturesque."

When American medical writers of the present day designate epidemic meningitis as "petechial" or "spotted" fever, although these terms were condemned by the first historians of the disease in this country as inappropriate, and although later experience and the revelations of morbid anatomy have alike demonstrated them to be incorrect, we are unwillingly led to conclude that either they are unacquainted with the history of the disease, or that they have not attentively studied its phenomena, or thoroughly investigated the evidences of its nature. In Europe this error has rarely been committed. With few exceptions, all who have written upon the subject, whether English, Irish, German or French authors, are substantially agreed that the proper title of the disease is *epidemic meningitis*, or *cerebro-spinal meningitis*. Even among the physicians of Dublin, those only who were least familiar with its phenomena

indulged in that luxury of nomenclature to which allusion has already been made. In those of the foregoing pages which relate to the general history and description of the disease, as well as in those more particularly devoted to determining its nature and its proper name, it is hoped that the reader will find satisfactory reasons for giving it the only title which usage, authority and sound logic approve.

TREATMENT.

The difficulties involved in the questions which have hitherto been discussed in this essay, and which refer exclusively to the history, phenomena and nature of epidemic meningitis, are trifling in comparison with those that relate to the cure of the disease. These are partly inherent in the general subject of therapeutics, in which no problem whatever is susceptible of a categorical and permanent solution. They depend still more upon the epidemic nature of the disease in question; for this nature gives to diseases a much greater diversity of type and tendency than they ever assume in their sporadic condition. These difficulties are further multiplied by occurring in a disease which stands alone in all other respects; whose causes, phenomena and lesions, in a word, whose laws are specific, and whose varieties of type are as infinite as can be formed by the combination, in constantly varying proportion, of a special disease of the blood deranging the molecular actions of the economy, and an inflammation of the cerebro-spinal meninges, and even of the substance itself of the great

nervous centres. These reasons are sufficient to account for the divergent, and often opposite methods of treatment which have been adopted and recommended by physicians of equal sagacity, at different times and places. By some a most actively stimulating and tonic method has been pursued, because the disease, in their experience, was one of utter prostration from the commencement, a "sinking typhus" as they expressively termed it. To others active inflammation of the brain and spinal marrow, denoted by excruciating pain and tetanoid phenomena, appeared to call for the use of vigorous antiphlogistic measures, or the constitutional operation of mercury. Others, still, discerned an imperative indication for the administration of large doses of opium to counteract the spasmodic phenomena and the severity of the neuralgic and cerebral pain which are so distinctive of the complaint, without particular regard to the physical causes of the pain itself. These are the most prominent and characteristically different methods used in the treatment of epidemic meningitis; and while it seems probable that each may have been successful, and therefore right, as a general method applicable to one or another of the several types assumed by the disease, it is equally certain that a uniform, or even a general success can be claimed for neither of them. We are too apt to think, or at least to speak as if we thought that all cases of an acute disease are curable, and that the rate of its mortality is also a measure of our own ignorance or inefficiency. In this we greatly err. Our art is as little responsible for the enormous mortality of epidemic menin-

gitis as it is for that of cancer or tuberculosis, or for the rapidly fatal issue of certain wounds and other injuries. In epidemic meningitis, as in other acute, and especially epidemic diseases, many cases are fatal from the outset; the first symptoms of the attack are the first phenomena of death. On the other hand, many are so slight as scarcely to require medicinal interference for their cure. But the event of many others is determined by the appropriateness and the opportuneness of the treatment, of which we shall now attempt to furnish the elements; but their successful application depends upon the sagacity of the physician.

Antiphlogistic Method—Emetics.—All whose experience entitles their judgment to respect insist upon the necessity of the early application of remedies. The forming stage of diseases is a precious and a fleeting opportunity for their cure. The organic elements which are then crystallizing, or, if the figure seem more apt, germinating, and assuming a determinate and permanent form, may at that stage sometimes be dispersed by a judiciously vigorous treatment. Hence it is that emetics have always, until the present dainty epoch of therapeutics, been held to be useful, if not indispensable, remedies in the first stage of nearly all diseases. It was so during the epidemic of Geneva. Vieusseux attributes the mortality which then occurred, in great part to the neglect of evacuants used to combat the earliest symptoms of the attack. "The first, the principal, and often the only remedy" which he found necessary, was tartar emetic, in the dose of half a grain every ten minutes,

or sufficient to produce full and free vomiting. This dose was repeated five or six times, or oftener, according to its effects. Sometimes it arrested the vomiting, the fever, and the pain in the head immediately, and was generally sufficient for the cure. It is to be remarked that this treatment was applied to an epidemic which presented in a marked degree those purpurous spots which suggested the vulgar name of "spotted fever." Yet, if we are not mistaken, Vieusseux is the only writer by whom it is recommended. Strong and North condemn all evacuations until the energy of the system has been in some degree restored. Gallup admits that emetics have been used sometimes successfully, but that, after all, their good effects are doubtful. Hale, at the commencement, employed this method, but was disappointed in its effects, and soon omitted it. But where the stomach was manifestly deranged "previous to the attack of fever," it sometimes arrested the progress of the disease. Tartar emetic and ipecacuanha together were prescribed by Hale. Miner condemned emetics as liable to produce uncontrollable vomiting, and therefore dangerous exhaustion. In Europe this method has, with the exception stated, been but little employed, and is generally disapproved. Yet Tourdes prescribed full doses of tartar emetic to twelve patients among those most dangerously ill, and near the commencement of the attack. Four of them recovered, and two seemed to owe their improvement to the medicine. We need not, therefore, absolutely shrink from using tartar emetic or ipecacuanha, or warm bitter infusions during the primary period of the disease,

according to the strength of the patient, hoping thereby to scatter the congestion which tends to produce exudative inflammation of the cerebro-spinal membranes, and to aid in eliminating the morbid material of the disease.

Purgatives.—Of these medicines little need be said. Experience has nothing in their favor to present, and there is no indication founded on analogy which is of sufficient weight to be regarded. As Miner remarks, "it is as safe to leave a wounded artery to nature, as in this disease to administer a cathartic, without directing its free operation to be *instantly* checked by opium. . . . One patient was seen, that sunk irretrievably, by a single operation of an enema." Except upon the dangerous ground that a remedy must be directly addressed to every symptom, there is no room for cathartics in this disease. The constipation, if any exists, yields usually without purgative medicine, and is, in fact, and as far as it goes, a sign of health rather than of disease.

Depletion.—If a judgment were now, for the first time, to be pronounced upon the value of depletion in this disease, it would certainly be unfavorable; but a suspicion might fairly be entertained that it had been biased by the doctrines, or prejudices, whichever they may be, of the present day. But when we look at the history of epidemic meningitis, which includes a period when blood-letting was a cardinal point of doctrine in the orthodox creed, we still find that the weight of authority was opposed to its use. During the first epidemic in this country, Strong informs us, some persons had recourse to the lancet, hoping to

relieve the patients from the depression supposed to depend upon congestion; but upon finding that "the pulse, instead of rising, sunk still lower after a moderate bleeding, they laid aside their lancets." Foot, North, Hale, Jackson and Miner, among the early American authorities, agree in condemning it; Gallup, alone, advocated depletion on the ground of its relieving internal congestion, allowing the heart to act more freely, and favoring diaphoresis. He insisted that it was "often necessary and sometimes indispensable." The "grounds" just stated can only afford a foundation for practice, in so far as the practice is justified by experience; in that case they are superfluous, or are merely useful in enabling us to generalize them as facts along with other similar facts. The testimony of Ames upon this question is so circumstantial and decided that we transcribe it almost entire, only reminding the reader that the epidemic to which it relates was one in which neither ecchymoses nor other evidences of blood dyscrasia were prominent, but in which, on the contrary, cerebro-spinal inflammatory lesions attained their fullest development. Blood-letting "was employed, with few exceptions, only near the beginning of the attack. It was used frequently, and boldly, without regard to the state of the circulation, that is, as readily and freely in the congestive as in the inflammatory forms. The quantity taken at one bleeding, or at several in quick succession, was sometimes very great—on one occasion the quantity ascertained to have been taken at a single bleeding was forty-eight, and on another forty-four and a half ounces. In many other instances

bleedings equally large, or larger than these were had, but the precise quantities were not ascertained. In one case which I visited in consultation, eighty ounces were taken at several bleedings within twenty-four hours. In a case treated by Dr. Boling, a female, fifteen years old, with the notes of which I have been furnished, there was taken by cups from the neck and occiput forty-eight ounces, and from the arm twenty-six ounces, all within eighteen hours. These are extreme quantities; in the greater number—the quantity taken altogether from adults in one day, varied from fourteen to forty ounces—in twenty-six cases, the average was found to be thirty ounces. The effects of blood-letting were not so satisfactory as might have been expected. Within my own observation they were never promptly decisive for much good or evil; the pulse in congestive cases rarely ever filled up, or became regular from it; in some instances it became quicker and more feeble during, or soon after rather a small bleeding taken on the first day of the attack. In the inflammatory form, also, the same thing was occasionally observed, though in this form an improved state of the pulse was more frequently the immediate consequence of the loss of blood. The most common sensible effect, however, was relief to the cephalagia, but even this advantage was not always gained. In the case referred to above, of the loss of forty-four and a half ounces at one bleeding, the pain which was distressing to the last degree, was hardly at all relieved, although the pulse was enfeebled by it, and the face made pale at the time, and for several days afterwards. In another instance in which the

symptoms, besides the cephalalgia, seemed urgently to call for this remedy, no relief whatever was obtained from it, notwithstanding that both the pulse and skin were greatly affected by it, as in the other case just mentioned, and a tendency to syncope was much complained of during and for some time after the abstraction of blood. Nevertheless, prompt and free bleeding in the early stages, and the earlier it seemed the better, must, I think, have been of considerable advantage in this epidemic in both the congestive and inflammatory forms. Though the benefit was neither immediate nor decisive, yet I cannot doubt in surveying the whole ground, that time at least was gained by it for other remedies more obviously beneficial to produce their effects. It is certainly true, however, that the impression of the physicians generally here in regard to bleeding, even in the bold, and I may be allowed to add, the judicious manner in which it was applied, was one of disappointment."

In Europe, among others who adopt the same views, may be mentioned De Renzi, who says, "we have little reason to be pleased with its effects. Employed the first day of the disease with great moderation, and in young and robust patients, it to some extent moderated the severity of the symptoms, but not to a very gratifying degree." Tourdes tested to the fullest extent the treatment of this disease by depletion; his testimony, in an abridged form, we subjoin. "From one to four times each patient was bled to the extent of from eight to sixteen ounces; from fifty to two hundred leeches were applied to the temples, the mastoid processes, &c." Now, "what

was the influence of this antiphlogistic treatment? the statistical results furnish a peremptory reply: the mortality nearly reached the proportion of two-thirds. Assuredly such a result leaves no doubt whatever in regard to the general uselessness of the depletory method." This is certainly a very mild judicial sentence. It follows from the reports of different French physicians, whose testimony is collected by Boudin, that nearly all formed an unfavorable opinion of the curative power of depletion. Mottet asserts that depletion, whether general or local, is always mischievous. Lefévre, Faure, Besseron, Corbin, Maillot and Laveran, pronounce it to be either useless or injurious. Faure Villars lost 42 patients out of 101 treated by the antiphlogistic method. About four pints of blood were taken from each. Rollet claims to have cured by an equally sanguinary practice all of fourteen cases, in which he judged the membranes only of the cerebro-spinal axis were inflamed, and six out of ten cases in which he diagnosticated a simultaneous inflammation of the nervous centres. Forget, Mouchet, Magail and others, equalled, if they did not exceed these physicians in the lavish expenditure of blood, which, fortunately for them, was not their own.

It is not easy to distinguish between the relative values assigned by experience to general and to local depletion, for in the greater number of reports both measures were conjoined. Yet the impression seems to have been that the latter is less open to objection than the former. In the epidemic at Rastatt, Niemeyer found local depletion so efficient in relieving pain, provided that it was early resorted to, that he

attributes to it the most useful influence. But others have made the observation, which we are able to confirm, that in young persons, and especially in children, the least abstraction of blood may be followed by dangerous exhaustion. Our own observation would lead us to conclude that in the more sthenic cases, scarified cups applied to the nape of the neck and along the cervical vertebræ are of essential service in mitigating, and generally, indeed, in wholly removing the neuralgic pains which form so prominent and so severe a symptom in many cases of the disease. When any abstraction of blood appears to be contraindicated by the patient's debility, dry cups afford him signal relief, and render the effects of vesication more prompt and complete.

Cold to the Head and Spine would almost instinctively be employed by any physician acquainted with the pathological changes going on in the nervous centres in this disease, or even by any one who witnessed the patients' complaints of pain in these parts. In the Massachusetts Society Report of 1810, we read, "cold water, snow and ice have been applied to the head. These applications have been made when there was violent pain in that part with heat and flushed face, and when there was violent delirium. The cold applications have in these cases afforded great comfort to the patient, and have mitigated or removed those very important symptoms. Sulphuric ether dropped on the head and allowed to evaporate has produced similar good effects." Rollet recommends that whenever the head is warm or there is a tendency to drowsiness a bladder containing pounded ice with bran

should be applied. Niemeyer thinks highly of such applications in the first stage, and especially of cold effusions upon the head while the patient is in a warm bath. Sanderson saw beneficial effects arising from ice to the head and to the spine during the forming stage. Mannkopf strongly recommends cold applications to the head; and Hirsch pronounces them the best of all the antiphlogistic remedies employed in this disease. To these judgments we substantially subscribe; but we believe that the value of the remedy is almost entirely restricted to the forming stage of the attack, and while the pain in the head is most intense. Its soothing influence is then very marked. Heat of head is not an essential indication; for even in the most violent cases its degree is rarely extreme, and it is often entirely wanting. Pain calls more distinctly for the remedy, but, when this symptom has subsided, the application is more annoying than grateful to the patient. The best method of applying cold is that already mentioned, *i. e.* a bladder containing pounded ice mixed with bran. But cold affusions are also very valuable, especially in children, whose thin skulls permit the prompt and full operation of the remedy. A long rubber bag filled with iced water is sometimes fastened round the head. Its shape, color and projecting brass screws give it a revolting aspect, and its weight renders it oppressive.

External Stimulants.—*Blisters*, it will readily be supposed, have been employed whenever the evidences of active inflammation within the cranium and spine were believed to exist; but they were also prescribed originally to relieve pain in these parts. Perhaps

they have been esteemed more valuable by American than by European physicians. Strong found that they checked vomiting and relieved coma, and stimulated the whole system; but that in the more violent cases the skin was not vesicated by them. In the comatose variety, North says, "I have thought a blister applied to the nape of the neck a very useful remedy," and he also advises it to relieve pain in the head. Gallup says that "blistering ought to follow as soon as the patient has had warmth applied in the first instance." He prescribes the application of blisters to various parts of the body as general stimulants, as well as to the scalp and neck for their revulsive operation. Jackson states that vesication "has been followed by the most important good effects;" and Hale, while confirming all of these statements, qualifies them with the remark that he found blisters to exhibit so much less power of relieving coma in this than in other febrile affections, that he at last ceased to prescribe them for that symptom. The substantial lesions (exudation, softening) in the one case, and the simple congestion in the other, suffice to explain this perfectly correct statement, and they also demonstrate the necessity of resorting as early as possible to these remedies, in order to obtain from them their full advantage. Yet we think that Hale underestimated the epispastic treatment. Miner appreciated it more highly when he urged the necessity of stimulating the whole system by heat, &c. and the skin by rubefacients, before attempting to blister; then, he remarks, "the freest application and repetition of them was attended with the most obvious beneficial

effects." . . . "In every case" he adds, ("the very mildest are not with safety excepted), the forehead, and in the severe, the vertex should be immediately blistered. Shaving the head and blistering it *early*, is more serviceable than any other external application." . . . "So sensible were those patients who had their reason, of the beneficial effects of blisters, that they frequently begged to have them repeated." Ames furnishes equally positive testimony; he says, "blisters were found to be very valuable applied to the upper part of the vertebral column; in mild and grave cases they seldom failed to remove or greatly relieve the cephalalgia. In the malignant varieties, also, the relief afforded by them was frequently very great." Hirsch remarks, that while this treatment may not exert a substantial influence upon the course or issue of the disease, it no doubt, in some cases, produces a diminution of the phenomena denoting depression; while Tourdes asserts that blistering the scalp, the spine, or other parts, increased the pain without mitigating a single symptom. It is evident from all of these statements taken together, that the utility of blisters in this disease is far from being uniformly evident. It seems probable that in different epidemics they differed in their operation according to the presence or absence of unknown conditions; for the testimony, inconsistent as it is, cannot be rejected. Were we to judge according to our own experience alone, we should assign to blisters, applied to the occiput and nuchæ, a very high place among the remedies for certain forms of this disease; for we know that they relieve or remove pain, diminish de-

lirium, spasm and coma, and therefore contribute as directly as any other remedies, if not much more so, to the favorable issue of the attack. But to accomplish these salutary effects of their use, they must not be employed when the disease assumes a malignant type, nor in any case after its constitution has become definitely fixed. Rollet is the only writer upon this subject, we believe, who recommends still more energetically revulsive agents. When the skin was not irritated by blisters, he employed the actual cautery on either side of the spinous recesses of the vertebræ, and from the head to the loins. Such "barbarous experiments," as Hirsch appropriately calls them, require no especial comment, particularly as no one has yet been bold enough to repeat them.

In the early history of epidemic meningitis in this country we find much greater stress laid upon various means adapted to warm the patient's body than is to be observed in recent publications upon the subject either in Europe or America. "The body MUST be got warm, the skin moist, and the energy of the pulse restored, or THE LIFE OF THE PATIENT IS GONE," are the emphatic words of Strong. "The unanimity predominant is sufficient to establish the fact respecting the utility of heating and sweating remedies," says North. According to Jackson, "the patient is first put into a warm bath (others insist that it shall be hot) or his feet bathed in warm water; then being well rubbed, he is to be laid in bed between blankets, and bedclothes added in proportion to his sensations or to his actual temperature when his sensibility is very much diminished. Around him are to be placed

bottles of hot water or billets of wood heated in boiling water and wrapped in flannel, or he is to be wrapped in flannel wrung out of boiling water; sinapisms are applied to the feet, and he is to swallow frequently some warm liquid," . . . "as hot infusions of the leaves of mint, pennyroyal and other similar plants, wine whey, wine and water, wine, brandy and other ardent spirits more or less diluted, camphor, sulphuric ether and opium. It is not generally thought useful to excite profuse sweating, but important to maintain it from twenty to forty hours, and even longer in some instances. Soup and cordials are at the same time administered. Under this treatment most commonly the violent symptoms, and not very rarely all the appearances of disease have subsided." It is difficult to explain why a method which has in its favor the testimony of sound experience, and the strongest possible reasons based upon analogy and the well established principles of therapeutics, should have fallen into such disuse as almost to have been forgotten. It cannot be because the type of disease requiring it is no longer met with, for, during the recent epidemic, physicians have become familiar with all its types and grades from the malignant to the inflammatory. One exception to the statement just made is furnished by Gordon, who says, "what I have seen most useful in the stage of collapse is external warmth applied to the entire surface by means of flannel bags containing roasted salt, applied along the spine, along the chest, inside the arms, and to the feet and legs, and between them."

Internal Stimulants.—Except typhus fever, there

is no disease in which the due administration of stimulants, and especially of alcohol, may become more essential to its successful treatment. But as the type of the disease varies from time to time between malignant and inflammatory extremes, the need of stimulants may be very slight or quite imperative. In point of fact, we find that while in the early history of epidemic meningitis in this country alcoholic and other stimuli were sometimes lavishly used, they formed but a subordinate and generally quite an insignificant part of the method usually adopted in Europe. How far the former course was pursued by our professional predecessors in imitation of the British treatment of typhus, or how far the latter plan was preferred by the French physicians of 1836, and subsequently, because they had been educated in the sanguinary school of which Broussais and Bouillaud were chief teachers; or how far, finally, the method of treatment in each case was determined by the predominant genius of each particular epidemic, it may not be possible to determine; but, probably, each of these influences had its share in the result. Indeed, it seems quite certain that the earlier American physicians who did not know, or who only knew imperfectly, that one element of the disease was inflammatory, and who were naturally influenced by those of its phenomena which led some among them to call it "sinking typhus,"—it seems quite certain, we say, that they should at first incline to the free use of stimulants; just as it is natural in Europe, where its first epidemic visitations fell within the period when inflammation dominated in pathology,

and its inflammatory element was immediately discerned, that the tendency should have been to counteract the disease by the most powerful weapons of the antiphlogistic armament. But time, which, in all things blunts the extreme edge and point of mischievous error, has modified and, as we believe, improved the therapeutics of this disease by demonstrating the dangers to which the sick are exposed, alike from an excessively stimulating and an extremely antiphlogistic method of treatment.

The predominant view among American physicians of the first epoch with which we are concerned is well illustrated by the language and precepts of Strong, who says: "the first, the great, I had almost said the only indication of cure" is "to support the vital energy, to raise the patient from his depressed state, and to hold him up till the disease passes off." He then adds that this purpose is to be carried out "by a proper use of nutritious diet, and of tonic, cordial and stimulating medicines." This "proper use," he clearly explains, will depend upon the condition of the patient; some cases will require only hot aromatic infusions, others wine, and others, again, brandy, either simple or spiced. He relates the case of a delicate female who took more than a quart of brandy in the course of eight hours, and a grain of opium every two hours; and when the brandy could not otherwise be retained it was administered saturated with loaf sugar. This treatment roused her from a comatose, cold, and almost pulseless state, with constant hiccough besides, and saved her life. So North lays down the general precept, that "the tonic and stimulating method of

cure, as opposed to the debilitating plan, is the correct one," while he admits that the degree of its use must be regulated by the physician's sagacity. In regard to the form of stimulus, he remarks, "fermented liquors of every kind may be used: of these claret, port and Madeira wine are preferred. Those who supposed distilled spirits are equally suitable, as general remedies, are much mistaken; though these may have their use as sudden stimulants." Again, he lays down the valuable rule that wine is often beneficial even where it is not necessary. Woodward observed that very large quantities of wine or ardent spirits may be given without doing any injury. Arnell says: "in some cases I have given a quart of brandy in six or eight hours with the happiest effect." Haskell and his associates maintain that "the bold and liberal use of diffusible stimuli is the only safe and efficacious mode of treatment." Fiske, however, denied the necessity of this method in ordinary practice, using stimulants only as auxiliaries in cases of extreme debility. Fish takes nearly the same view; but insists upon the liberal employment of alcohol by enema as well as by the mouth, and in conjunction with opium, spices, and external stimulants when reaction was difficult to obtain, or the vomiting obstinate. Other writers present, however, a very modified estimate of the treatment by stimulants and cordials. The committee of the Massachusetts Medical Society distinctly state that a division of opinion among physicians existed respecting the utility of such articles, while there was a popular bias in their favor. They condemned their liberal and indiscriminate adminis-

tration, and stated their conviction that a considerable proportion of the most judicious practitioners, and even of those who formerly employed that method, had learned by experience to regard it as highly injurious. At the same time they admitted the necessity of such medicines where the patients' faintness and debility gave the indication. Gallup adopted this judgment as his own, and Hale advocated the same discriminating use of these remedies. He also condemned their habitual employment at the beginning of the attack, while admitting their utility, and even necessity, where the prostration of strength and the apparent depression of the vital powers were extreme. A few teaspoonfuls of hot brandy he found often successful in arresting vomiting. "Alcohol," according to Miner, "was highly beneficial in some cases, and required to be employed freely in many; but it seemed not to be equally adapted to all, and on the whole, was of much less importance than opium."

Nearly all of the more recent observers of epidemic meningitis assign a very subordinate position to alcoholic stimulants in the catalogue of remedies, and some, as Ames, Tourdes, Niemeyer, Hirsch, Mannkopf, &c., make no mention of them whatever. In the late Irish epidemic they were, however, regarded as important. For our own part, while we consider these agents as altogether indispensable in the conditions of the system described by Miner, Hale and others, we are satisfied that their too free exhibition entails the gravest peril, by intoxicating the patients, and oppressing, where they are intended to rouse the

vital energies. On taking charge of the medical wards at the Philadelphia Hospital, we found that the patients were using as large quantities of alcohol as in typhus fever; but a very short period of observation rendered it so apparent that an excess in their administration was indulged in, that the dose of the medicine was first diminished, and finally it was omitted altogether, unless such special indications arose as have already been pointed out. This change was followed by a manifest improvement in the general aspect of the sick, and the subsidence of symptoms which, it then became evident, were attributable to a lavish use of stimulants rather than to the gravity of the disease. On the whole, we regard alcohol as a medicine which ought not to be included in the ordinary and systematic treatment of epidemic meningitis, but as a cordial to be held in reserve against those signs of failure in the power of the nervous system, which call for its administration in diseases of whatever name. In this, as in so many other respects, epidemic meningitis presents a striking contrast to typhus fever.

Opium.—A very distinguished physician writing upon this disease, remarks: "even opium has upon the Continent enjoyed the reputation of curing this malady, *but upon what principle it is difficult to imagine.*" Cinchona, mercury and arsenic, have the reputation of curing, respectively, malarial diseases, syphilis and squamæ, and although it is difficult to imagine upon what principle they do so, we apprehend that no one will contest their efficacy. A volume of speculations upon the nature of epidemic meningitis and on the action of opium are valueless in comparison with the

direct and accumulated proofs of the curative power of the medicine in this disease with which the literature of our profession abounds. It interests us also, and in an especial manner, because it is an American remedy, and was not, as Hirsch and others state, first proposed by Forget or by Chauffard. By whom it was first employed may not be easy to determine, but that, in this country, it was in common use from the year 1808, the publications of that year and of immediately succeeding years abundantly demonstrate. Strong is the first who alludes to its use to relieve coma, and he urges that if the medicine is rejected from the stomach it should be administered by the rectum. "Opium," he remarks, "either pure, or in the form of laudanum, was found a most excellent stimulant in every stage of this disease. The best manner of exhibiting it appeared to be in small doses often repeated, so that the system should be constantly under a gentle influence from it. It tended to relieve pain, increase the excitement, and remove delirium and stupor. The necessary dose varied according to the mildness or violence of the symptoms, from ten drops of laudanum every hour to thirty drops every two hours. In those cases of the disease especially, which commenced with sudden and violent delirium, this medicine exceeded all others in its beneficial effects. In such cases, however, the dose required was often large, but when exhibited with great freedom, it produced the happiest and most striking effects." A case is then related in which excruciating agony in the head and maniacal delirium were predominant symptoms. Sixty drops of laudanum were

administered every hour until 480 drops, or half a fluidounce had been taken in the course of eight hours. The whole of it was retained, and it subdued the excitement and allayed the pain, but produced no sleepiness nor any other apparent effect of opium. In a like heroic manner Haskell employed this remedy. He speaks of a young woman who recovered, but who during her illness took more than a quart of brandy and not less than twenty grains of good Turkey opium, and that without any evidence of intoxication. "Indeed," he adds, "we have been obliged frequently to exhibit ten grains of opium for a dose in some of the violent cases attended with strong spasms, and have never known it to produce stupor in a single instance." So Miner states that "a few cases imperiously required half an ounce of the tincture in an hour, or half a drachm in substance, in the course of twelve hours, before the urgent symptoms could be controlled, and even some cases required a drachm in the same time. All these patients recovered." This sagacious observer and judicious thinker further says: "opium was the most important remedy in the severe form of this disease. . . . The whole of those patients whose symptoms were promptly met with opium invariably recovered." Among the symptoms which it was particularly intended to relieve was one which is usually thought to be increased by narcotics, viz., coma. This object is particularly mentioned by Strong; Hale, also, who advised tincture of opium with oil of peppermint or lavender, frequently repeated, to relieve coma, remarked: "whatever may be the explanation of its mode of action, it is certain

that this was a powerful agent in removing the deepest comas which were not absolutely irrecoverable." Such, indeed, is substantially the testimony of Woodward, Bestor, Arnell and others, of that period, who employed opium for pain, vomiting, diarrhœa, and sleeplessness. Among the writers of the first period of the prevalence of the disease in this country, Gallup is the only one who passes an unfavorable judgment upon this drug. He employed it only in cases attended with cholera morbus. Otherwise he discarded it altogether. "Observing the bad effects of opium," he remarks, "in certain cases not in my control, I had determined to see if the disease could not be managed without it;" and he then states that of eighty-one decided cases committed wholly to his care, and treated without opium, one case only proved fatal. It is evident that such a low rate of mortality could not have been furnished by cases of this disease requiring any active treatment at all.

Of more recent American observers the judgment is not uniform upon this subject. Ames does not appear to have tested the opium treatment, for his whole opinion in regard to it is contained in these lines: "from what I saw of it I can scarcely say that it was generally safe to give opium in the inflammatory malignant variety, or that it was of any use in the congestive malignant form. In the other varieties it was a safe remedy, and very valuable as an anodyne merely." Upham only notices opium as a means of procuring sleep at night. Russell employed it to control delirium; and Woodward prescribed it if the skin was moist, but thought that it aggravated

the head distress. But, on the other hand, Jewell affirms that "opium stands not only at the head of the list of stimulants, but also at the head of remedial agencies in this disease;" and Kendall says, "anodynes, even in large doses, in the early stage, seemed to increase the watchfulness; but after the first period had passed, and an evacuation from the bowels had been procured, they often quelled the intense restlessness like a charm."

The greater number of European physicians who made use of this remedy, prescribed it in doses quite too small to serve any good purpose, except as a palliative. This statement is true of the practice pursued by Forget, Tourdes, Gaskoin, Sanderson and others. Some, also, like Bricheteau, adopted, as an argument against its use, the vicious question, *how* could it do good? But others, like Chauffard, who administered it in doses of from three to fifteen grains pronounce it to be incomparably the most efficacious remedy. Its most earnest advocate was Boudin. He increased the dose of the drug in proportion to the severity of the symptoms, and frequently administered from seven to fifteen grains in a single dose at the commencement of the attack, and subsequently one or two grains every half hour. This method was steadily pursued until the patient began to be sleepy, or his symptoms abated, and then the use of the medicine was still persevered in, although its dose was diminished. During the active stage of the disease a remarkable tolerance of the drug was observed. It never produced constipation, or at least did not increase that which already existed. Our own observations cor-

roborate these results fully. We were in the habit of giving one grain of opium every hour, in very severe, and every two hours in moderately severe cases, and in no instance was produced either narcotism or even an approach to that condition. Under the influence of the medicine the pain and spasm subsided, the skin grew warmer and the pulse fuller, and the entire condition of the patient more hopeful. It seemed probable, however, that the full benefit of the opium treatment could be received by those only who were subjected to it in the early stages of the attack. Direct experience is here in perfect accord with the expectation which a knowledge of the pathological processes involved in the disease would naturally suggest.

Cinchona and Quinia.—It has been very customary for those who had to treat epidemic meningitis during its late prevalence to associate large doses of sulphate of quinia with the opium which they administered. A careful examination of the evidence does not prove either the necessity or the utility of this association. In the early American epidemics, before quinia was discovered, physicians made use of Peruvian bark in powder, tincture, decoction, &c. But two observations were speedily made; the one was that the stomach would not tolerate doses of the bark large enough to display antiperiodic virtues, and the other was that smaller doses were perfectly unavailing against the proper elements of the disease. The medicine then was made use of as a mere tonic during the decline of the attack and during convalescence. Such is the testimony of Strong, North, Fish, Jackson, Hale, &c.

After the introduction of the alkaloids of cinchona into medical practice, the sulphate of quinia was largely employed for the cure of the disease we are studying. But its effects were not generally regarded as salutary. Love tells us that when, owing to the apparently periodical character of the symptoms, large doses of quinia seemed to be indispensable, they were injurious and not beneficial. Ames had "but little to say in favor of this medicine." . . . "When the disease was attended with a fever which was regularly remittent, the meningitis appearing as an appendage, or as if engrafted on a remittent fever, quinine did occasionally arrest the paroxysms, but more slowly and with greater difficulty than in other fevers. As a remedy in other varieties it cannot be recommended; its use here, if not hazardous, never affording much encouragement to repeat it." Boling "saw it succeed in two intermittent cases which were not very violent, while it failed in others of a graver character." Upham states that quinia, in some instances to the extent of sixty or even eighty grains was given within twelve hours from the first attack, but without effect; and Jewell found it useful only as a tonic. In Europe all of the most reliable observers of this disease formed the same estimate of quinia in its treatment as physicians had formed in the United States; and this statement refers particularly to Tourdes, Faure Villars, Barrilleau and Brossard, Sanderson, Mannkopf and Hirsch. C. Broussais, indeed, presents as a case of cerebro-spinal meningitis cured by sulphate of quinia, one of completely intermittent paroxysms with spasms of the

flexors of the forearms! Evidently an error of diagnosis was committed. Chauffard also relates, as a case in point, one which recovered after five grains of opium and fifteen of sulphate of quinia had been administered. But the share of the opium in this and similar instances must not be overlooked. On the whole, it is evident that opium alone, in large doses, will control the disease in many instances, and that quinia in large doses will remove the complication, when it exists, occasioned by miasmatic poisoning; but there is no evidence sufficient to show that epidemic meningitis has ever been cured by sulphate of quinia alone. In accordance with general belief in the efficacy of this medicine we have usually associated it with full doses of opium; but should the occasion again be presented, we shall feel constrained to discard sulphate of quinia except as a tonic during the decline of the attack.

Alteratives — Mercurials. — It is very certain that mercury has entered more generally into the treatment of epidemic meningitis than any other medicine; and, were this fact alone considered, the propriety of continuing to prescribe it could scarcely be called in question. When, moreover, it is remembered that of all medicines for the cure of other forms of meningitis, this one has the greatest weight of testimony in its favor, there would seem to be a decided preponderance of motives for its employment against the epidemic under discussion. We leave out of consideration here the emphatic judgment of many recent therapeutists against it as a remedy for any form of inflammation, believing that the grounds

of their conclusions are less extensive than they are claimed to be, if, indeed, they are not altogether unsound. But in this, as in all similar cases, the proof by analogy is one that requires to be very cautiously and narrowly scrutinized. It very seldom affords a substantial basis for practice. At the best, it can only be regarded as a suggestion for the trial of a medicine, whose real utility must afterwards be determined by direct observation and experiment. To those who regard epidemic meningitis as a purely zymotic or blood disease, and the meningeal lesion as a subordinate or accidental morbid element, or who consider the affection a form of typhus fever, the application of mercury to its cure must appear an extremely irrational and highly imprudent measure; while those who view it as preëminently and primarily an inflammation, may urge in support of the use of mercurials in its cure, that it is justified by established doctrine in regard to the therapeutical operation of these medicines. But if we look upon the disease as one in which a zymotic and an inflammatory element are combined in varying proportions, it would seem to follow that while mercury might benefit one class of cases, it would seriously injure the other. And if, once more, we turn to the only true source of light in resolving such questions, we shall perhaps find that experience, as final arbiter, pronounces an equivocal judgment, and leaves the problem virtually unresolved. We shall perhaps learn that while this medicine has been more generally employed than any other, the proofs of its salutary operation, as distin-

guished from vague impressions, are far from being precise or clear.

Looking, now, to historical testimony for light upon this question, we learn that neither North nor Strong nor Miner nor Gallup employed mercury in the treatment of epidemic meningitis. Miner, referring to it as a purgative, says of this class of medicines, "*juvant per casum, nocent per se;*" and he adds, "in a few bad cases, in which a slight mercurial action was excited, it was of no sort of service." In Europe we find the following testimony given by Tourdes: "frictions with mercurial ointment upon the scalp, the thighs, in the armpits and along the spine were employed, while calomel was administered internally. In three cases, one of which was fatal, salivation occurred. In spite of the large doses and the steady application of this medicine, it was generally unavailing." Hirsch, also, regards mercurial purgatives as of slight value, and mercury as an antiplastic medicine of very questionable value. He adds that, even apart from its mischievous effects in certain cases, the observations of Tourdes, Guepratte, Chauffard, Falot, Corbin, Lindström, Wunderlich and others, do not lead us to repose much confidence in its efficacy. On the other hand, Bestor writes: "within three or four hours from the attack, I usually gave from eight to ten grains of calomel, not with a view to purge on the first day, but to act as a stimulus to the system, and to prepare the bowels to be moved by injections on the following day;" and Arnell, Fish and Woodward advise the same method, which, it need scarcely be remarked, is justified neither by theory nor experience. Others,

more rationally, sought to produce the constitutional effects of the medicine. "If," says Fiske, "we were bold and liberal in the use of anything, it was calomel" until a slight affection of the glands was obtained; and Danielson and Mann gave to a child one hundred grains of calomel in doses of three grains each, when the patient died,—as was most natural that it should do, although the authors style this method "a stimulating process." According to Jackson, the success of the mercurial practice "was not exceeded by that of any other." But this judgment is afterwards qualified by the remark that although in cases where life is immediately threatened the remedy cannot be relied on to avert the danger, yet that it is of great value where the most urgent symptoms are removed by other remedies. This conclusion is less favorable, perhaps, than the authors appear to have regarded it. Ames employed mercury almost exclusively to produce its constitutional effects, and regarded its beneficial influence as more prompt and permanent than that of blood-letting. It was, he believed, always safe if not always effectual. Upon this testimony Drake remarks that "it cannot be regarded as decisive." Kendall found "calomel in large doses" the best remedy in the first stage of the disease; Dickson purged with calomel and rhubarb followed by croton oil; Iredell regarded it "of the utmost importance to push the mercury to the extent of producing its constitutional effects;" and Upham reports small doses of calomel with ipecacuanha to have had a good effect in several instances. Renzi attributes to blue mass, among other effects, the resolution of the abdominal(?)

inflammation, and asserts that a cure followed the production of mercurial sore mouth. He was under an impression that it directly neutralized the poison and expelled it from the system. According to Mayne, the chief reliance is to be placed on the internal and external use of mercury; and Gordon recommends small doses during the stage of reaction.

It cannot be doubted that these witnesses are far from agreeing with one another. Between those who absolutely neglect, or positively condemn the use of mercurials in epidemic meningitis, and those who eulogize them as the best of all remedies, an impassable gulf is fixed quite as wide as that which separates those who found in mercury a "stimulus to the system" or an "alterative of the minima vascula" (Jackson), and those who attributed to it an antidotal action upon the poison itself. The mode of its curative action would be of interest, certainly, to determine, but it is of a very remote and subordinate interest when compared with the primary and capital problem, is the medicine curative at all? But upon this question we have no satisfactory data; no comparison of cases treated with and without mercury; no enumeration of the special symptoms which it favorably influences; no statement of the mortality occurring under its use. Its virtues, according to some, depend upon its purgative operation, while others regard its salivant action as alone efficient. Are the former right when experience demonstrates that all other purgation in this disease is mischievous; or are the latter right, when Tourdes, who carried the method furthest, unequivocally condemns it? It cannot be alleged that

the epidemic which Tourdes witnessed was one ill adapted for the mercurial treatment. To do so would be not only to admit that for some types of the disease such medicines are unsuited, it would also be to make an erroneous statement; for the epidemic at Strasburg was the one, above all others, which demonstrated that the anatomical character of the disease consists in an exudative inflammation of the cerebro-spinal meninges. Shall it then be denied that mercury is a suitable agent in the cure of this disease? By no means, unless the proposition is made a general one, including all of the multiform types which epidemic meningitis presents. Its malignant and typhoid forms must, of course, be regarded as unsuited for any treatment by mercury. A very large proportion of other cases tend to cure rather than to death, and do not demand, even if they do not absolutely forbid, the employment of so debilitating a remedy as the one in question. But there remains another group of cases whose general expression is sthenic; in which the pulse is comparatively strong, the skin warm if not hot, the pains in the head, spine and limbs severe, and the tetanic phenomena marked;—in these, if in any, the use of mercury would seem to be justified by analogy, and perhaps, though of this the evidence is not conclusive, by direct observation. We have never employed the medicine in such cases, nor, indeed, in any others, for the remedies before considered appeared to be sufficient for the cure; but had we another epidemic to encounter, we should certainly put to the test whatever virtues mercury might possess

for mitigating the severity of the disease, and hastening its cure.

There remain to be noticed several other medicines, concerning which at different times favorable opinions have been expressed. One of these, and the earliest, in point of time, is the solution of *arsenite of potassa*. It was originally exhibited in this disease by Danielson and Mann. What first suggested to them the idea of using it does not appear; but they resorted to it after the failure of evacuants and of bark and wine, giving to a child three years old "two drops in a tablespoonful of wine." The influence of the wine in this prescription was certainly not either negative or trifling. A further trial of it by other physicians led to the judgment expressed by Strong several years later, that "although it has not been sufficient in all cases, still it has appeared to be a safe and very useful medicine, and in many cases the most happy effects have evidently been produced by it." It was regarded as a direct stimulant of the most powerful description. "It tends," says Strong, "to increase the excitement, often in the course of a few minutes producing a very pleasant sensation of warmth through the whole system; and tends more than any other medicine to remove the cold and singular sensation at the stomach, which has been mentioned as being so peculiarly distressing." Fish ascribed similar effects to the medicine, and took the same view of its operation. But the Massachusetts committee, from the survey of a wide field of experience, expressed no positive judgment as to its value; and in 1825, Miner wrote, "arsenic was highly serviceable when the head

was much affected, and the stomach at the same time torpid. In some irritable cases it answered well, but it was necessary to adjust the dose very accurately, in order to have its full effect on the one hand, and not offend the stomach on the other." The medicine was also used by Hale, Gallup and other physicians of the day, either for the purposes just indicated, or as a tonic during convalescence. In the history of later epidemics, whether in this country or in Europe, we have met with no reference to the use of arsenic, nor have we employed it in our own practice; but if the statements which have been quoted are correct, the omission of this medicine in the treatment of epidemic meningitis is a grave fault.

Iodide of potassium has been used during the decline of the disease for the purpose of exciting the absorption of the lymph effused beneath the meninges. There is a theoretical probability of its usefulness.

Several physicians, disregarding the conclusions of universal experience in favor of opium, and preferring to follow the *à priori* road which always leads to disappointment or error, concluded that since *belladonna and ergot* had been shown to diminish vascular action in the cerebro-spinal axis, they necessarily become specific remedies for cerebro-spinal meningitis. Indeed, one writer so far forgets the rules of medical logic as to conclude that because, in his opinion, the views of Brown-Séquard on the action of belladonna and ergot are correct, *therefore* opium and alcohol "are decidedly *contraindicated* in the treatment of the disease under consideration." Upham states that in 1863 Haddock recommended ergot, upon the grounds

just referred to, during the epidemic at Newbern, North Carolina, and that "several of the cases thus treated recovered." Under the impression which thus originated as to its efficacy ergot was prescribed by Borland in three cases, which also recovered. In California, Peake advised its use on theoretical grounds, but made no statements of its success in his hands. Woodward appears to have allayed pain in the head in this disease by the use of belladonna; and Gordon, in Dublin, prescribed two grains of sulphate of quinia and one grain of extract of belladonna every three hours in a case marked by collapse, dark eruption, extreme pain in the head and neck, and strabismus. When it is known that the head was at the same time shaved and blistered, the influence of the belladonna in promoting the cure may be regarded as more than equivocal. The same writer used belladonna with advantage, externally, to relieve dysphagia, and around the eyes in cases of ulcerated cornea, &c.

Diet.—The remarks which have been made in regard to the appropriateness of diffusible stimulants in those cases of epidemic meningitis which are characterized by exhaustion, imply the necessity of employing a nutritious diet under similar circumstances. But such a diet is hardly less applicable in ordinary cases of the disease which do not require the exhibition of alcohol in any form. In European epidemics this important matter has too often been either overlooked, or a degree of abstinence from food enjoined which we cannot but regard as inappropriate if not injurious. It would seem incredible to any one acquainted with the disease that an honorable and skillful physician

had advised absolute diet and emollient drinks in its treatment (Rollet), if other heroic measures of an opposite nature and which no one has had the courage to imitate, had not also been recommended by him as the most efficient means of cure. Hirsch, also, after stating that in the commencement of the attack there is generally complete anorexia, declares that even after some appetite has been felt, the strictest rules of diet should be observed, and only the blandest articles of food allowed. Such are not the conclusions to which experience really points, nor are they justified by a thorough study of the genius of the disease.

If its history has been correctly written in these pages, it presents few cases of a purely sthenic nature; its predominant tendency is towards a typhoid state, or one of pure asthenia. Now, nothing can be considered more firmly established than the precept that the treatment of a disease should be governed by its type rather than by the local morbid process which accompanies it. It appears, therefore, that even upon general grounds a strict diet is not indicated. Again, if it be true that opium and stimulating and tonic remedies are more appropriate for the cure than the antiphlogistic and evacuant methods, it cannot at the same time be true that a rigid abstinence from food should be enjoined. Once more, those who accept the doctrine that all disease, even sthenic inflammations, and *à fortiori* asthenic and typhoid conditions, are only proofs of a struggle between the natural and the morbific powers in which the former are to be supported by every expedient, must, of course, admit that in this case there is a loud and emphatic call for

supporting measures, including nutritious food. Our own practice has, in general, been to prescribe such food as it is customary to employ in typhus fever, having been led thereto by the debility of the patients, the uncertain and often compressible pulse, the cool extremities, the eruptions upon the skin, the absence of alvine disturbance in the greater number of cases, and the evident dependence of the gastric derangement upon irritation of the brain. In this, it appears, we did but follow the example of early American physicians, who were guided by the prevalent symptoms to direct a nutritious diet, as they were also led to prescribe a liberal use of opium. Strong insists firmly and repeatedly upon this plan, advising "soup made from chicken, veal, mutton and beef, richly seasoned with pepper and savory herbs," and adds, "this is a very important part of the process and ought by no means to be neglected." These articles were advised to be given during the height of the disease; and afterwards, it is added, "the stomach soon begins to crave something more solid than soup; oysters, beefsteak, cold ham, or neats' tongue are received with peculiar relish. Often have I seen convalescents *when they had hardly strength enough to raise themselves in bed*, make a hearty meal of the above-mentioned articles, which were received with great satisfaction, sat well upon the stomach, and were well digested and assimilated." The same advice, substantially, is given by Hale, who recommends soups at first and then solid food, for the latter of which he observes that the patients early have an appetite; and by Jackson and his colleagues, who

direct the most nutritious food that can be digested, and add, that it is not very important to abstain from it even during the first stage of the disease. These precepts are the same, substantially, which are furnished by all American writers whose experience entitles them to weight in the decision of this question, which we hold to be of capital importance in the management of epidemic meningitis.

The general *regimen* to be observed consists in the use of the ordinary measures which are adapted to promote the repose of the patients in low forms of fever; but an additional suggestion, to which the greatest importance was attached by the writers just referred to, is that great care should be taken to prevent the patient from making any unnecessary exertion, and especially from assuming the erect or even the sitting posture before convalescence is fully established. The necessity of these precautions arises from the singular debility which characterizes so many cases of the disease, and which, as was before pointed out, suggested the title of *typhus syncopalis*, which was conferred upon it.

BIBLIOGRAPHY.*

Adams, J. F. A., Boston Med. and Surg. Jour., Aug. 1866, p. 66.

Ames, S., N. Orleans Med. and Surg. Jour., Nov. 1848.

Anderson, W., Trans. Med. Soc. of Penna. 1864, p. 438.

Andral, G., An Essay on the Blood in Disease. Am. ed., p. 73.

Anonymous, N. England Jour. of Med. and Surg., i. 151; ii. 228, 241; iii. 166; iv. 238.

——— British Med. Jour., July 8, 1865.

——— Lancet, April, 1865, p. 436; May, 1865, p. 549.

Armstrong, W. G., Am. Jour. of Med. Sci., July, 1866, p. 279.

Arnell, D. R., American Medical and Philosophical Register, vol. i. p. 12, and p. 176.

Atlee, W. F., Amer. Jour. of Med. Sci., July, 1864, p. 94.

Baldwin, W. O., Amer. Jour. of Med. Sci., Oct. 1866, p. 321.

Baltzell, W. H., Am. Jour. of Med. Sci., Oct. 1865, p. 368.

Banks, Dr., Dublin Quart. Jour., May, 1866, p. 448; and Feb. 1867, p. 98; Dublin Med. Press, June, 1867, p. 580.

Barrilleau et Brossard, Bulletin de l'Acad. Royale de Méd., 1844, ix. 894.

Bartholow, R., Cincinnati Lancet and Observer, 1864, p. 392.

Bartlett and Wilson, Med. Repository, 1812, p. 40.

Bestor, J., In North, 1810.

Black, J. R., Am. Jour. of Med. Sci., April, 1865, p. 345.

Boling, W. M., N. Orleans Med. and Surg. Jour., May, 1847, p. 732.

Borland, J. N., Boston Med. and Surg. Jour., May, 1865, p. 309.

* This list includes only the original monographs, reports, &c., referred to in the body of the Essay. A more general and complete Bibliography of European treatises is furnished by Hirsch and also by Mannkopf.

Boudin, C. M., Histoire du Typhus Cérébro-Spinal. Paris, 1854.
Traité de Géographie et de Statistique Médicales. Paris, 1857.
Bull. de l'Acad. de Méd., xiv. 600; xv. 20.
Brossard, *vide* Barrilleau.
Burdon-Sanderson, J. Report of the results of an inquiry into the epidemics of cerebro-spinal meningitis prevailing about the Lower Vistula. London, 1865.
Burns, R., Am. Jour. of Med. Sci., April, 1865, p. 339.
Butler, L. C., Trans. of Vermont Med. Soc., 1864, p. 32.

Catlin, B. H., Trans of Amer. Med. Assoc., xvi. 471.
Cayol, Revue Méd., lxxxvi. 237.
Chandler, J. L., Boston Med. and Surg. Jour., April, 1864.
Chauffard, Revue Méd , 1842, lxxxvi. 190.
Cheever, D. W., Boston Med. and Surg. Jour., April, 1866, p. 242.
Chester, C., N. Orleans Med. and Surg. Jour., Nov. 1847, p. 314.
Clark, C. M., Chicago Med. Jour., Jan. 1867, p. 1.
Claubry, Memoires de l'Acad. Nat. de Méd., xiv. 155; xvi. 15.
Cogan, Dublin Med. Press and Circular, May, 1867, p. 506.
Comstock, J., Boston Med. and Surg. Jour., Oct. 1865, p. 237.
Condie, D. F., Trans. Med. Soc. of Penna., 1864, p. 497.
Corson, W., Trans. Med. Soc. of Penna., 1863, p. 232.
Corson, H., Trans. Med. Soc. of Penna., 1865, p. 95.
Craig, J. W., Buffalo Med. Jour., July, 1858.
Croly, H. G., Dublin Med. Press and Circular, May, 1867, p. 526.

Danielson & Mann, Medical and Agricultural Register. Also, in North. 1806.
Day, Henry, Clinical Histories. London, 1866, p. 1.
Dickson, J. H., Trans. of Amer. Med. Assoc., xiii. 307.
Drake, D., Principal Diseases of the Valley of North America. Philadelphia, 1854.
Draper, W. H., Amer. Med. Times, Aug. 1864, p. 98.
Dunbar, Med. Repository, 1813, p. 357.

Edes, R. T., Am. Jour. of Med. Sci., July, 1864, p. 274.
Ellis, C., Boston Med. and Surg. Jour., June, 1864.

Fassett, O. F., Trans. of Vermont Med. Soc., 1864, p. 43.
Faure-Villar, Bulletin de l'Acad. Royale de Méd., 1841, vi. 589.
Fenner, E. D., Southern Medical Reports, ii. 17.
Fish, H., Remarks on the Spotted Fever as it prevailed in Hartford, Conn., in 1809. In Trans. of the Physico-Medical Society of New York. New York, 1817.
Fiske, O., In North. 1810.
Foot, W., Philadelphia Medical Museum, 1808, v. 248.
Frentzel, Med. Times and Gazette, April 22, 1865.
Frothingham, W., Amer. Med. Times, April, 1864, p. 207.

Gamage, W., Some account of the Fever, &c. of 1817 and 1818. Boston, 1818.
Gervis, H., Med.-Chir. Trans. (1811), ii. 234.
Gilbert, D., Am. Jour. of Med. Sci., July, 1864, p. 140; July, 1865, p. 93.
Gillkrest, J., London Med. Gazette, July, 1844, p. 455.
Githens, W. H. H., Notes of 98 cases. Amer. Jour. of Med. Sci., July, 1867, p. 17.
Green, T., Trans. Med. Soc. of Penna., 1864, p. 472.
Gallup, J. A., Sketches of Epidemic Diseases in the State of Vermont. Boston, 1815.
Gauné, Archives Générales de Méd., Janv. 1858, p. 1.
Gerhard, W. W., Amer. Jour. of Med. Sci., July, 1863, p. 105.
Gordon, S., Dublin Quart. Jour., May, 1867; Dublin Med. Press and Circular, May, 1867, pp. 508, 551.
Greene, J. S., Boston Med. and Surg. Jour., Nov. 1865, p. 256.

Hale, E., History and Description of an Epidemic Fever, commonly called Spotted Fever. Boston, 1818.
Hartshorne, H., Amer. Jour. of Med. Sci., July, 1864, p. 93.
Haskell, A., Spooner, M., and Holmes, F., In North. 1810.
Haverty, Dublin Med. Press and Circular, May, 1867, p. 525.
Hayden, Dublin Med. Press and Circular, May, 1867, pp. 530, 579.
Hicks, B. J. and Taylor, B. F., New Orleans Med. and Surg. Jour., July, 1847, p. 49.

Hirsch, A., Handbuch der Historisch-Geographischen Pathologie, i. 163; Die Meningitis Cerebro-Spinalis Epidemica. Berlin, 1866.
Holbrook, Boston Med. and Surg. Jour., June, 1865, p. 369.
Hughes, J., Dublin Med. Press and Circular, May, 1867, p. 510.
Hutchinson, J. H., Am. Jour. of Med. Sci., July, 1866, p. 125.

Jackson, *vide* Welsh.
Jenks, E. W., Buffalo Med. and Surg. Jour., Oct. 1863, p. 81.
Jewell, J. S., Cerebro-Spinal Meningitis; a report made to the Illinois State Med. Society. Chicago, 1866.
Jewell, W., Am. Jour. of Med. Sci., July, 1864, p. 129.

Kay, Isaac, Boston Med. and Surg. Jour., June, 1864.
Kempf, M., Amer. Jour. of Med. Sci., July, 1866, p. 55.
Kendall, J. V., Trans. of Med. Soc. of the State of New York, 1858, p. 96.
Kennedy, H., Dublin Med. Press, June, 1867, p. 551.
Ketchum, B. T., Trans. of the Vermont Medical Society, 1865.
Kirtland, J. P., American Med. Recorder, xiv. 441.
Klebs, Virchow's Archiv, xxxiv., 327.
Köhler, H., Monographie der Meningitis Spinalis. 1861.

Law, R., Dublin Quart. Jour., Nov. 1849, p. 317; May, 1866, p. 288. Med. Press and Circular, June, 1867, p. 548.
Lebert, H., Anatomie Pathologique, vol. ii. p 22. Paris, 1858.
Leedom, E. C., Trans. Med. Soc. of Penna., 1864, p. 445.
Lefèvre, M., Récherches Historiques sur la Maladie qui a regné au bagne de Rochefort en 1839. Paris, 1840.
Lente, F. D., Am. Med Times, July, 1864, p. 14.
Levick, J. J., Trans. of Amer. Med. Association, xvii. 311. Am. Jour. of Med. Sci., July, 1864, p. 135; July, 1865, p. 277.
Levy, M., Bull. de l'Acad. Emp. de Med., xiv. 765; xv. 20.
Lidell, J. A., Am. Jour. of Med. Sci., Jan. 1865, p. 17.
Lionet et Petit, Bull. de l'Acad. Imp. de Méd., xiv. 952.
Love, T. N., N. Orleans Med. and Surg. Jour., July, 1848.
Lyman, E., In North. 1808.
Lyons, Dublin Med. Press and Circular, May, 1867, p. 509.

Mann, J., Medical Sketches of the Campaigns of 1812, '13 and '14, p. 19, and p. 306; *vide* Danielson.

Mannkopf, Ueber Meningitis Cerebro-Spinalis Epidemica. Braunschweig, 1866.

Martin, E., An Essay on the Epidemics of the Winters of 1813 and 1814, p. 74. Baltimore, 1815.

Marques, J. A., Brit. and For. Med.-Chir. Rev., April, 1863, p. 389.

Mathey, Journal de Méd. Chirurg. and Pharm., &c. An. xiv., xi. 243.

Mayne, R., Dublin Quart. Jour., Aug. 1846, p. 95.

McDowell, London Jour. of Med., iii. 850.

Millar, J., Epidemic in St. Petersburg. Edinb. Journ., xi. 225.

Miner, T. and Tully, W., Essays on Fevers, &c., p. 114. Middletown, 1823.

Miner, Thomas, Typhus Syncophalis, Sinking Typhus, or the Spotted Fever of New England. Middletown, 1825.

Minot, F., Boston Med. and Surg. Jour., March, 1864.

Moore, Dublin Med. Press, June, 1867, p. 579.

Moorman, J. W., Am. Jour. of Med. Sci., Oct., 1866, p. 386.

Murchison, C., Lancet, April, 1865, p. 417.

Niemeyer, F., Die Epidemische Cerebro-Spinal Meningitis. Berlin, 1865.

North, E., A Treatise on a Malignant Epidemic, commonly called Spotted Fever. New York, 1811.

Oliver, J. L., Trans. Med. Soc. of Pennsylvania, 1864, p. 429.

Page, Calvin G., Boston Med. and Surg. Jour., Sept. 1865, p. 109.

Parks, Jr., L., Boston Med. and Surg. Jour., March, 1864; Publications of the Massachusetts Med. Society. Boston, 1867.

Peake, H., San Francisco Med. Press, Jan. 1865.

Pearce, T. J., Cincinnati Lancet and Observer, May, 1865.

Petit, *vide* Lionnet.

Poley, F. B., Trans. Med. Soc. of Penna., 1863, p. 237.

Prewitt, T. F., St. Louis Med. and Surg. Jour., 1865, p. 205.

Reid, J. K., Trans. Med. Soc. of Penna., 1863, p. 232.
Renzi, S. de, Storia del Morbo Petecchiale Nosocomiale. Napoli, 1833.
Rollet, M., Memoires de l'Academie Royale de Médecine, 1843, x. 291.
Roupell, G. L., A short Treatise on Typhus Fever. Amer. ed., 1840, pp. 119, 120, 121.
Russell, J., Boston Med. and Surg. Jour., May, 1864.

Sargent, J., Am. Jour. of Med. Sci., July, 1849, p. 35.
Saunders, A. L., Trans. of the Med. Society of the State of New York, 1859, p. 153.
Sherrill, H., An Essay on Epidemics, &c., p. 29. New York, 1832.
Simon, Lancet, May, 1865, p. 481.
Smith, Southwood, A Treatise on Fever. Amer. ed., 1838, p. 155.
Spooner, *vide* Haskell.
Squire, T. H., Trans. of Med. Society of the State of New York, 1858, p. 155.
Stillé, A., Amer. Jour. of Medical Sci., July, 1864, p. 133; Jan. 1865, p. 121; July, 1866, p. 156.
Stokes, Dublin Med. Press, June, 1867, p. 580.
Strong, N., Med. and Philosophical Register. Philadelphia. New Series, i. 12, 1811.
Stuart, J. B., Med. Repository, 1812, p. 23.

Taylor, *vide* Hicks.
Thomas, D. G., Trans. of Med. Soc. of the State of New York, 1858, p. 89.
Tourdes, G., Histoire de l'Epidemie de Méningite Cérébro-Spinale observée à Strasbourg en 1840 et 1841. Paris, 1842.
Tully, *vide* Miner.
Tweedie, A., Clinical Illustrations of Fever. Amer. ed., Boston, 1831, p. 355, &c. Lancet, May, 1865, pp. 518, 571.

Upham, J. B., Boston Med. and Surg. Jour., April, 1863, p. 191.

Vieusseux, Journal de Med., Chirurg., Pharmacie, &c. An XIV., xi. 163.

Wait, R., Med. Repository, 1810, p. 391.
Warren, *vide* Welsh.
Watson, A. T., Amer. Med. Times, May, 1864, p. 222.
Webber, S. G., Prize Essay. Boston Med. and Surg. Journal, Aug. 1866, p. 29.
Welsh, T., Jackson, J., Warren, J. C., A Report on Spotted or Petechial Fever. 1810. In Med. Communications, &c. of Massachusetts Med. Society. Vol. ii., 1813.
Wilks, S., Lancet, April, 1865, p. 388.
Williamson, G., Philadelphia Med. Museum, 1808.
Wilson, J., Med. Repository, 1813, p. 351; *vide* Bartlett.
Wilson, Job, An inquiry into the nature and treatment of the prevailing epidemic called Spotted Fever. In three parts. Boston, 1815.
Woodward, S., In North. 1808.
Woodward, A. T., Amer. Med. Times, May, 1864, p. 232; Trans. of the Vermont Med. Soc., 1864, p. 23.
Wunderlich, C. A., Archiv der Heilkunde, 1864, p. 417; 1865, pp. 268 and 417.

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